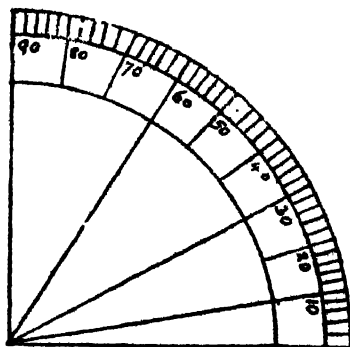


KA
GEOMETRY KHASI

(NA KA BYNTA KI CLASS IV, V & VI)



DA

U. N. L. KHARKONGOR, BA., BT.

All rights reserved

1979

La pynmih da

U. N. L. KHARKONGOR

Mission Compound, Mawkhar

SHILLONG.

KA
GEOMETRY KHASI

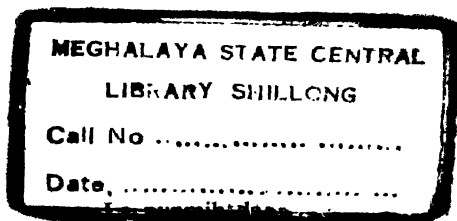
REFERENCE
Not to be
sent out

NA KA BYNTA KI CLASS IV, V & VI

DA

U N.L. KHARKONGOR B.A., B.T.

All rights reserved



U N. L. KHARKONGOR
Mission Compound, Shillong,
Meghalaya

Library books will give you Joy for LONG

First Edition—March 1958.
Second Impression—July 1958.
Third Impression—November 1959.
Fourth Impression—February 1963.
Fifth Impression—July 1966.
Sixth Impression—April 1969.

*La mynjur kum kə Text Book na ka bynta ki Class IV, V & VI ha ki
Secondary School ha U.K. & J. Hills da u Addl. D.P.I. Assam,
ha ka Gazette Notification No. 43, dated the 14th March
1958 kat kum ka shithi jong u kaba Memo
No. 1T/9/57/2176-81T, dated the 14th March
1958 bad ka shithi u A.I. Schools, Hills
No. T-3/66, dated the 26th May 1966.*

May 1979 — 8000 Copies

SHI KYNTIEN

Ka jingthmu ha kaba thoh ia kane ka kitab ka long ban ai ia ka nongrim kaba skhem ha ki nongpule kiba dang sdang ha ki kpait ka Geometry bad ban pynbang ban pule ia ka.

Ka Education Department ka la pynmih ka Curriculum kaba ban ba ha kaba hikai ia ki nongpule ba dang lung ka bor pyrkhath ia ki jingshisha kiba nyngkong ka Geometry, ka jingshemphang bad jingsngewthuh ia ki Geometrical terms bad ka jingpoi sha ka kut-nia ia ki jingshisha Geometry (Geometrical propositions) ka dei ban wan na kaba ring ne ot dur bad na kaba thew ba woh ia ki.

La pyrshang, namarkata, ban ialam na kawei ka jingshisha sha kawei pat, ha ka rukom ba ki nongpule ba danglung ka bor pyrkhath kin sngewthuh bad shemphang, da kaba seng nongrim ruh ha ki jingshisha ba la shem. Kane ka subject ka long uwei u kynjri uba la pyniasoh da kiba bün ki kyrwoh. Ka jingskhem ka nongrim ba la seng kan shong eh ha ka jingbymkheif sting ia kine ki kyrwoh la ki long kiba rit katno katno. Lada iwei i kyrwoh i dkut u kynjri baroh uwei u dkut. Lada iwei i kyrwoh i tlot u kynjri baroh uwei u tlot. Ka long kawei ka jingtei kaba kine ki kyrwoh ki long ka sorki, ki mawrit mawria kiba bat ia ka jingtei baroh kawei. Ki long ruh u maw halor u maw ba la buh ha ka jingtei. Wat niew sting, namar kata, ia kawei-pa-kawei ka jingpyrshang ba la buh ha kawei-pa kawei ka lynnong ha kane ka kitab. Ka jingpyrshang ban leh ia ki kan plie ia ki khmat sha ki jingshisha kiba long ka nongrim ban shem ia kiwei pat ki jingshisha.

Namar ka jingkhim ka por ha kaba ngi la hab ban pynmih ia kane ka kitab, ngi la hab ban shon kyrkieh ia ka. Ka lah eh ban long ba ki jingduna ne jingbakla kin paw hangne hangtai; ia kine ngi kyrpad ba ki nongpule ba sbun

kin máb. Ngin pdiang sngewbha ãa kino kino ki jingkynthoh
ne jingai jingmut lem jong phi ki nongpule, ki ban ãarap
ban pynbha shuh shuh ãa kane ka jingpyrshang kaba rit.

Khatduh ãawái, ngi ai khublei ãa kito ki paralok baroh
kiba ngin ym lah ñiew kyrteng lut hangne, kiba ãa
ãa} don kti lem — ãa khyndiat ne shibun — ha kaba pynmih
ãa kane ka kitab.

DATED SHILLONG :
12 tarik u Nohprah, 1957 }

U Nongthoh.

KI JINGKDEW

KI LYNNONG

REFERENCE
Not to be Lent Out

I Ki Dur Tylli (<i>Solids</i>)	...	...	...	1
II U Point bad u Line	..	...	...	2
III Ki Circle	..	...	..	8
IV Ki Angle	..	..	..	14
V Ki Angle (<i>shuh shuh</i>)	..	..	..	16
VI Ki Angle (<i>shuh shuh</i>)	..	...	...	21
VII Ki Angle (<i>shuh shuh</i>)	...	...	...	23
VIII Ka Jingkheif ia ki Angle na ki kti baje	..			26
IX Ki Vertical bad Horizontal : Ki Perpendicular bad Parallel	...	...	...	28
X Ki Dur Lai Dong (<i>Triangles</i>)	..	...		36
XI Ki Dur Lai Dong (<i>shuh shuh</i>)	...	..		42
XII Ban ot ia ki line bad phiah ia ki angle	...			46

Problem 1 — Ban ot ia u line marshiteng, da u ruler bad compass

Problem 2 — Ban phiah ar liang marbiang ia kano kano ka angle, da u ruler bad compass.

XIII Ban shna ia ki Angle 49

Problem 3 — Ban shna ka angle ka ban ia ryngkat bad ka angle ba la ai.

Problem 4 — Ban shna ka angle kaba 60° , da u ruler bad compass.

Problem 5 — Ban shna ka angle, kaba 120° , da u ruler bad compass.

Problem 6 — Ban shna right angle, da u ruler bad compass.

XIV Ki Parallel bad Perpendicular 55

Problem 7 — Ban ring u line u ban long parallel ia u line ba la ai, lyngba ka point ba la ai, da ka set square.

Problem 8 — Ban ring u line u ban long parallel ia u line ba la ai, lyngba ka point ba la ai, da u ruler bad compass.

Problem 9 — Ban bynta ia u line ha ki san bynta kiba ia ryngkat.

Problem 10 — Ban ring u line u ban ot marshinteng ia u line ba la ai uba da pynlong ki right angle, da u ruler bad compass.

Problem 11 — Ban ring u line u ban ieng perpendicular ha u line hu ka point kaba ha u line ba la ai.

Problem 12 — Ban ring u line u ban ieng perpendicular ha u line ba la ai na ka point ba shabar jong u.

KI LYNNONG	PAGE
XV Ban shna ki Triangle	63
<i>Problem 13 — Ban shna la ka dur lai dong haba la ai ka lynter ki side jong ka.</i>	
<i>Problem 14 — Ban shna triangle haba la ai ka jingheh ki lai tylli ki angle jong ka.</i>	
<i>Problem 15 — Ban shna triangle haba la ai uwei u side bad ki angle ha ki tduh jong u.</i>	
<i>Problem 16 — Ban shna triangle haba la ai ar tylli ki side bad ka angle kaba pynlong da ki.</i>	
<i>Problem 17 — Ban shna triangle haba la ai ar tylli ki side bad ka angle kaba ia pyrshah ia kawei na ki.</i>	
<i>Problem 18 — Ban shna ka right-angled triangle haba la ai ia u hypotenuse bad uwei u side.</i>	
XVI Ki Triangle (<i>shuh shuh</i>) — Ka jinglaryngkat ki ar tylli ki triangle nadong shadong (<i>congruence of triangles</i>)	70
XVII Ki Quadrilateral	74
<i>Problem 19 — Ban shra ka quadrilateral haba la ai ki side bad ka angle ba la pynlong da shi jvr ki side ba marjan.</i>	
<i>Problem 20 — Ban shna ka quadrilateral haba la ai ki side bad u diagonal.</i>	
<i>Problem 21 — Ban shna ka parallelogram haba la ai ki side ba marjan (adjacent sides) bad ka angle ba la pynlong da ki, da u ruler bad compass.</i>	

Problem 22 — Ban shna ka square ha u side ba la ai, da u ruler bad compass.

XVIII	Ban shna dur kat kum ka scale	..	..	83
XIX	Ki Circle	...	..	86

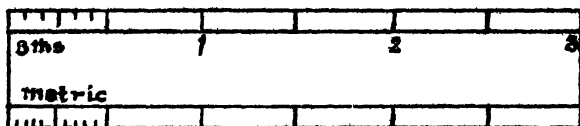
Problem 23 — Ban ring ka circle ka ban laid lyngbu la ki vertex jong ka triangle ba la ai.

Problem 24 — Ban ring ka circle ka ban laid lyngbu la ki vertex ka square.

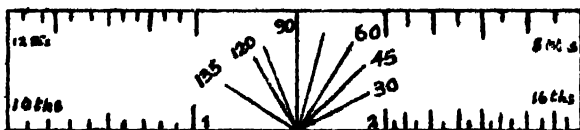
XX	Ban shna la ki katto katne ki nuksa.	...	90
----	--------------------------------------	-----	----

KI TIAR BA DONKAM

Haba pule ia kane ka subject ngi dei ban nang bha ia ka jingpyndonkam ia ki tiar kiba pyndonkam ha kaba ring dur. Ia kine ki tiar ki khot "Mathematical Instruments"



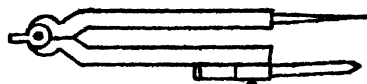
Dur 1



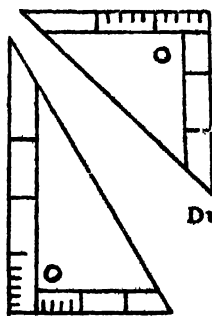
Dur 2



Dur 3



Dur 4



Dur

Dur 6

Ka dur 1 ka pyni ia kawei ka liang u flat ruler. Don ha u ka scale (jingthew) kaba da ki inshi bad metre.

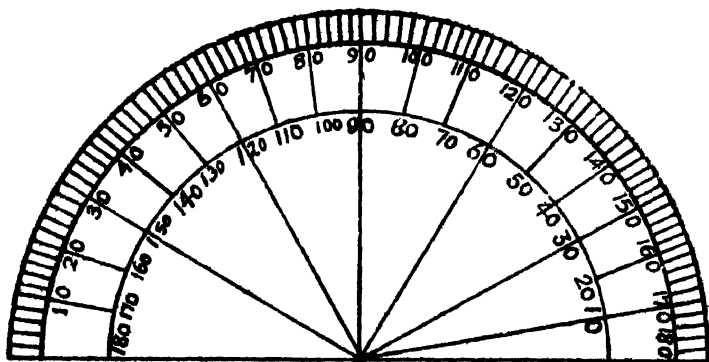
Ka dur 2 ka pyni ia kawei pat ka liang u flat ruler. Ha kane ka liang don ka scale 10 ksai shi inshi, 12 ksai shi inshi, 8 ksai shi inshi bad 16 ksai shi inshi.

Hamar pdong kane ka dur don ka jingthew ia ki angle (dong). Ia u flat ruler ia kham pyndonkam ha kaba ruid line (laiñ).

Ki dur 3 bad 4 ki dei ki nap ban pyndabynta ne thaw
ia ki line ne ruid jylli. Ki khot ia kine ki nap divider bad
compass.

Ka jinglapher ha kine ki nap ka long ba ha u divider
la pyndait da ki nar ha baroh ar liang ka nap katba ha u
compass pat ha kawei ka liang la pyndait da u nar bad ha
kawei pat da u let khnang ban paw dak let haba ring dur.

Ki dur 5 bad 6 ki dei ki set square. La kham pyndon-
kam ia ki ha kaba ring ia ki parallel (ki line ki bym ia kyn-
duh). Phin sa sngewthuh ia kane ynda phi la pyndonkam
ia ki ha ki lynnong kiba iadei.

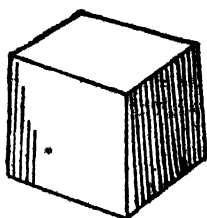


Dur 7

Kane ka tiar pat ka dei ka semicircle ne protractor. Yn
thaw ia ka jingheh ki angle ne shna ia ki da ka.

LYNNONG I

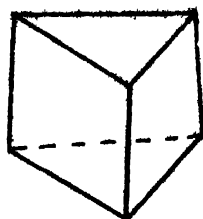
KI DUR TYLLI (SOLIDS)



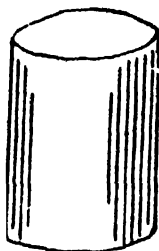
Dur 1



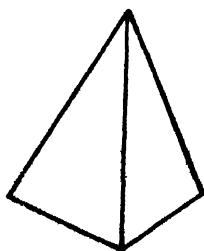
Dur 2



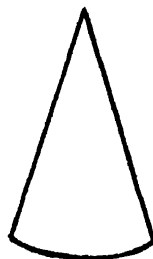
Dur 3



Dur 4



Dur 5



Dur 6

Kitei ki long ki nuksa lyngkhot dieng kiba long ki dur tylli (solids ne solid figures). La jér kyrteng la ki kat kum ki dur.

Ka dur 1, ka long ka dur synduk kad ki khot cube; ka dur 2, ka long ka dur pyrthei (sphere); kaba 3, ka long ka shiteng na ka dur synduk ba la ot pynfeng na'kawei ka dong ha kawei ka dong, ki khot la kane ka dur prism; ka dur kaba 4, ka dei ka dur tyndong (cylinder); kaba, 5 ka dei ka dur mot (pyramid); bad kaba 6, ka dei ka dur khoh (cone).

Ia kaba shabár kine ki dur tylli, kata ia ka bynta ba ngi lohi bad tba ki khot ka sla (surface).

Ka sla jong ka dur tylli ka'lah ban long tang kawei ka lyngkhot, kum ha ka dur pyrthei. Hynret ha kiwei pat ki

dur tylli don bún sla. Ka sla ka dur synduk ka don hyn-
riew sla ne hynriew khmat. Baroh ki khmat ka dur synduk
kiba madan (Plane).

Ki sla ka dur mot ki don san sla. Baroh kiba madan.
Saw tylli na ki ki nang rit nang rit sha khlieh haduh ba ki
shu nep shir na khlieh.

Ki sla ka prism ki don san sla kiba madan baroh.

LYNNONG II

U POINT BAD U LINE



Peit ha kane ka dur. Don saw tylli ki rong—kaba saw,
stem, blue bad jyrngam. Hamar pdeng kane ka dur kine ki
saw rong ki la shem. Ito i jaka la shem kine saw rong i dei
i point. I point, namarkata i long i dak iba rit katta katta
ba wat lada pyrshang thew la ka jingheh jong i da ki kor
pynheh dak kiba khlaifi katno katno, ym lah satia ban
thew la i. Na ka bynta ka jingtrei ha ki jingpule la kane
ka subject, la shu shim ba ino ino i dak ba la buh da u
let uba nep ha ka kot sada ne da u chalk ha ka blackboard i
long u point.

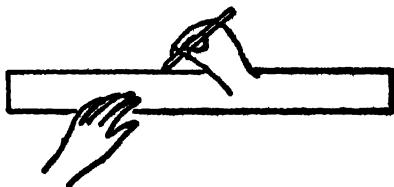
Lada pynladait lang ter ter la ki point ki pynlong kawei
ka lynter. Kumta lada phi peit biang ha kane ka dur phi
lohi ba kino kino ki ar tylli ki rong ki la shem ha kawei ka
lynter. la kane ka lynter ha kaba ki rong ki lashem la khot
u line. la u line, namarkata, la pynlong da bún tylli ki

point kiba la pyndait lang ter ter. U line um don jinghab hynrei tang ka lynter ne jingjrong. U line u lah ban long uba beit (straight) ne uba kdor ne khun (curved).

Ki ar tylli ki khmat synduk ki la shem ha u line. Ki lai tylli pat ki la shem ha u point. Kumjuh ruh ki sla ne khmat prism ki la shem ha ki line bad ha ki point.

Ha ka dur mot, ki ar tylli ki khmat ne sla ki la shem ha u line bad baroh saw pat ki la shem ha u point.

Ka khlieh mot ne ka tdong khoh kaba nep shlr ka dei u point.

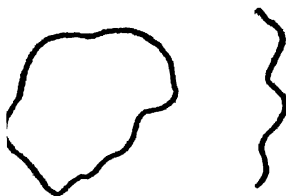


Shim la u Flat Ruler bad buh halor ka kotsada. Da u let uba nep bha pruid dak na rymmiang u Flat Ruler. I dak iba la ruid i dei u line uba beit (straight line).

Khylliap la ka kotsada ar pyngkhoh. Plied la kata ka khylliap. Kato ka dak khylliap ba pawdien ha ka kotsada ka long ka dien u straight line, la u straight line, namar-kata, la pynlong da ki point kiba la soh lang ter ter tang sha kawei ka phang. Ki rymmiang ba nep jong ka miej, jing-khang, blackboard, sla kot, dieng sawdong bad kiwei kiwei de ki long ki nuksa u straight line.

Shim pat la ka kotsada bad khylliap ar sien khylliap. Plien biang. Phi lohi ba ar tylli ki straight line ki la pom ha iwei i point. Khylliap pat lai sien khylliap ha kata ka rukom ba kane ka khylliap kaba lai kan laid lyngba i point ba la pom kito ki ar tylli ki straight line. Plied la ka. Mynta pat phi lohi saw tylli ki line ki la pom ha iwei i point. Lah ban leh la kane bunsien bad phin shem ba bun tylli ki straight line lah ban ring lyngba kawei ka point. Ngj ju lohi bun tylli ki surok ki la pom ne la shem ha kawei ka jaka.

Khmi h pat ha kane ka dur.



Kine ki line ha kane ka dur kim long kiba beit. Ki long kiba khun ne kdor. Ki khot ia ki ki curved line.

Haba phi iaid ia ka lynti kaba beit siak, ka khmat jong phi barobor ka phai sha kaju h ka phang. Hynrei lada phi iaid ia ka lynti kaba khun, ka phang jong phi ka iai kylla. Tharai mynta phi don ha ka lynti kaba ka khmat jong phi ka phai beit shaphang shatei. Ynda phi ia iaid katto katne phi shem ba ka khmat jong phi kam phai shuh shaphang shatei hynrei ka la phai sha kawei pat ka phang. Kane ka jia namar ba ka lynti ba phi iaid ka long kaba khun.

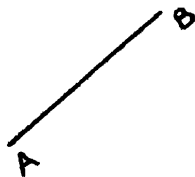
Kumta ia u curved line la pynlong da ki point kiba la pyndait lang ter ter na kawei ka phang sha kawei pat ka phang.

Ha kane ka kot habi ngi ong u 'line' ngi mut u 'straight line' lynda la pynshai da kumwei pat.

Kaba jér kyrteng ia u point bad u line :— Khnang ban pyniapher ia uwei u khynnah na uwei pat, la jer ia ki da ki kyrteng. Kumta ruh khnang ba lah ban pyniapher ia uwei u point na uwei pat u point, ne ia uwei u line na uwei pat, dei ban jer kyrteng ia ki kumne:—

Buh ar tylli ki point ha ka kotsada ia uwei u point ngi jer kyrteng A da kaba buh u dak A hajan u point, ia uwei pat B bad kumta ter ter.

Pyniasoh la kine ki point A bad B da u ruler bad u let uba nep. Ngi loh u line uba kyrteng AB. Ngi shu ong u line AB. Kynmaw, ia ki point ngi ong u point A ne u point B; hynrei ia u line ngi ong u line AB.



Ka Scale — Ngi la ong ba ha u Flat Ruler don ka scale kaba la phér la phér. Lah ban thew la ka lynter uno uno u line da ka jingiarap kano kano ka scale.

Ka scale 8 ksai shi inshi ka mut ba la ka shi inshi la bynta ha ki 8 bynta kiba marbiang marbiang bad iwei iwei na kita ki bynta i long shi ksai jong ka scale.

Ka scale 10 ksai shi inshi ka mut ba la ka shi inshi la bynta ha ki 10 bynta kiba marbiang marbiang bad iwei iwei na kita ki bynta i long shi ksai jong ka scale.

Ia ka scale 12 ksai bad 16 ksai shi inshi la bynta ha ki katno bynta?

Jingpyrshang I

1. Ha ka scale kaba 8 ksai shi inshi, $\frac{1}{2}$ inshi $\frac{1}{4}$ inshi, $\frac{3}{4}$ inshi long katno ksai?

Jubab ha kane ka rukom :—

Ha ka scale . . . ksai shi inshi, $\frac{1}{2}$ inshi long . . . ksai.

2. Ha kajuh ka rukom jubab ia kine :—Ka $\frac{1}{4}$ inshi, $\frac{1}{2}$ inshi, $\frac{3}{4}$ inshi, $\frac{5}{8}$ inshi, $\frac{7}{8}$ inshi, ka long katno ksai ha ka scale 16 ksai shi inshi?

3. Thew ia ka lynter bad ka pyngkiang ka sla kot jong phi da ka scale 8 ksai bad ka 16 ksai shi inshi.

4. Ring ia kine ki line kiba ka lynter jong ki ka long $2\frac{1}{4}"$, $3\frac{3}{8}"$, $1.9"$, bad $3\frac{3}{8}"$ bad da thoh artad ia ka jingjriong jong ki halor uwei-pa-uwei u line ba phi ring.

Jingbatai—ine i dak (') i mut 'phut', ine pat (") 'inshi'. Kumta haba thoh $2' 3\frac{1}{4}"$ ka mut 2 phut $3\frac{1}{4}$ inshi. Ka long ka rukom thoh lyngkot ia ki ktein 'phut' bad 'inshi'.

5. Lada ar tylli ki line ki jriong $4\frac{1}{4}"$ bad $1\frac{5}{8}"$, katno ka jingjriong lada pyndait lang ia ki? Leh ia kane da kaba ringdur bad sa thew de. Pynshisha ia kaba mih da kaba kheifi.

Ka rukom kumno ban leh:—

Ring uno uno u line AB.



Thew ia ka jingjrong 4 inshi shi ksai da u divider na ka scale 8 ksai. Thew ia kane na u line AB da kaba buh ia kawei ka tduh jong ka nap ha ka point A bad ba kawei pat ka tduh kan hab ha kano kano ka point ha u line AB. Jer kyrntong ia kata ka point K. U line AK u long $4\frac{1}{8}$ inshi.

[Khmi hba ba u divider un long uba skhem.]

Thew pat ia ka jingjrong 1 inshi 5 ksai na ka scale 16 ksai da u divider. Thew pat ia kane ha u line AB da kaba buh ia kawei ka tduh u divider ha ka point K bad kawei pat kan hab ha kano kano ka point D ha u line AB (lah ban pynjrong ia u line AB katba donkam). Mynta u line KD u long $1\frac{5}{8}$ inches.

Thew ia ka jingjrong u line AD da u divider bad sa thew ia kane ha ka scale 16 ksai. Da kaba leh kumne phi shem ia ka jingjrong u line AD. Kane ka long ka jingjrong jong ki ar tylli ki line ba la ai haba pyndait lang ia ki.

$$\begin{aligned} \text{Kheif pat : } & -4\frac{1}{8} = 4 + \frac{1}{8} \quad [= \text{ka mut ia ryngkat bad}] \\ & \quad \quad \quad 1\frac{5}{8} = 1 + \frac{5}{8} \\ \hline & 4\frac{1}{8} + 1\frac{5}{8} = 5 + \frac{6}{8} \text{ lane } 5\frac{3}{4} \end{aligned}$$

Jubab ia kine harum da kaba ring dur bad kheif ruh :—

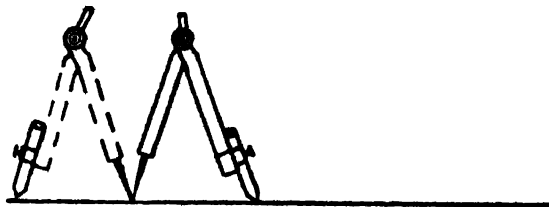
6. Lada ot $1\frac{1}{2}$ inches na u line uba $3\frac{5}{8}$ inches, ka jriong katno kata kaba sah?

7. Lada ot $2\cdot3$ inches na u line uba $4\frac{1}{2}$ inches ka jriong katno kata kaba sah?

Ban ring line uba ar shah, láí shah ía ka jingjrong u line ba la áí.

Tharai la áí u line uba 2 inshi ka jingjrong.

Ring shuwa uno uno u line.



Thew ía ka jingjrong 2 inshi da u compass. Buh ía kawei ka khmut u compass ha kawei ka tduh jong u line bad sa thew 2 inshi na u.

Nangta, jám shi jám, ar jám, láí jám ha u line ban íoh ía ka shi shah, ar shah, láí shah ter ter jong u line ba la áí. Ka jingjrong ka jingjám ka dei ban long barobor kat ka jingjrong u line ba la áí.

8. Uwei u line u jrong 1-4''. Shem ía ka lynter jong u line uba láí shah ía ka jingjrong u line ba la áí.

9. Uwei u line u jrong $\frac{1}{2}$ '' . Shem ía ka lynter jong u line uba 4 $\frac{1}{2}$ shah ía ka jingjrong u line ba la áí.

10. Ka shi powa jong ka 5-6'' ka long katno?

11. Katno tylli ki line lah ban kér kut ía kano kano ka jaka? Ring láí tylli ki line ban kér kut ía kawei ka jaka. Ring saw tylli ban kér kut ía kawei pat ka jaka.

12. Ar tylli ki curved line ki lah ne em ban ker kut ía kano kano ka jaka? Lada lah, ring dur ía kata.

13. Uwei u curved line u lah ne em ban kér kut ía kano kano ka jaka? Ring dur ban pyni nuksa ía kata.

14. Katno tylli ki line lah ban ring lyngba kano kano ka point? Pyni nuksa da kaba ring dur.

15. Buh ár tylli ki point A bad B ha ka kotsada. Pynlasoh ía ki. Katno tylli ki curved line lah ban ring na u A ha u B? Ring láí tylli kiba kum kita.

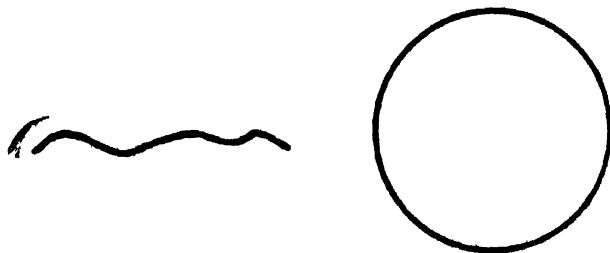
16. Buh láí tylli ki point A, B bad K ha ka kotsada ki bym ía don ha ujuh u line. Katno tylli ki straight line phi lah ban ring da kaba pynlasoh ár ár ía ki?

17. Buh pat sáw tylli ki point kumba phi leh ha ka Ex. 16. Katno tylli ki line lah ban ring da kaba pynlasoh ía ki ár ár?

LNNYNNONG III

KI CIRCLE

Ha ka lynnong kaba ía dep ngi ía pule ba u line u ía lah ban long uba beit (straight), uba kdor ne khun (curved). Peit pat ha kine ki dur.

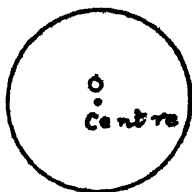


Ha kawei na kine ki dur ngi lohi ía ki tduh u line. Ha kawei pat ngim lohi ía ki tduh jong u line. Ía kaba kum kane ka dur ki khot ka jylli. Phi ju ruid jylli haba ía puh latom ne haba ía beh ling jaifi?

Lada phi teh ia u kulái ha madan bad phi pynmareh sawdong ia u ha kata ka rukom ba u tyllái ba phi teh ha ka ryndang kulái bad ha u dieng ba phi sieh ha madan un pyr-
khing bha bad un shád sawdong ia uta u dieng, phi lohí ba ka lynti ba u kulái u pynlong ynda u la laid búnsien búnsien ka dei ka jylli. Kata ka bynta kaba la kér kut da kata ka lynti ba la pruid da ka jinglaíd tawiar u kulái ki khot ka circle.

Ka circle ka long ka dur kaba la kér kut da u line uba ka jingjngai na u point baneh hajuh (fixed point) sha uno uno u point ha uta u line ka la long katjuh.

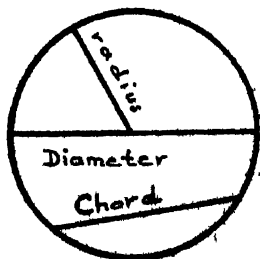
Kumno ban ring dur ia ka circle? Shim ia u compass. Buh iwei i point ha ka kotsada. Khot kyrteng ia ita i point O. Pied ia ka nap ha kata ka rukom ba ka jingjngai ki tduh ka nap kan long $1\frac{1}{2}$ ". Buh ia ka tduh ka nap nar ha u point O. Pyntyllun ia ka nap ha kata ka rukom ba ka tduh ka nap ba don let kan ruid dak ha ka kotsada kumba phi beh ia u kulai ba u her sawdong ia u dieng ba phi teh uba sieh ha madan. Ka dur ba la ring ka dei ka circle.



Ia une u line uba kér kut ia ka circle ki khot circumference bad ia ka point O ka centre.

Ring katto katne tylli ki line na ka point O sha ka kano kano ka point ha ka circumference. Thew ia ka jingjrong jong ki. Phi shem aiu? Ia uwei-pa-uwei na. kine ki line ki khot radius (plural: radii).

U radius jong ka circle u long u line uba la ring na ka centre sha kano kano ka point ha ka circumference. Baroh ki radius jong ka circle ki la marshak. Lah ban ring bún tylli ki radius ha ka circle-



Lada pynjrcng la uno uno u radius haduh ba un da la kynduh pat la ka circumference, ngi loh ar tylli ki radius kiba ha ujuh u line. Ia une u line ki khot diameter.

U diameter jong ka circle u long line ba la ring na kano kano ka point ha ka circumference sha kano kano kawei pat ka point ha kajuha circumference u da laid lyngba ka centre. Katno tylli ki diameter lah ban ring ha ka circle?

Ka semicircle ka long ka shiteng jong ka circle. Uno uno u diameter u ot la ka circle ha ki ar tylli ki bynta kiba la biang. Kawei na ki ka long ka semicircle. Ia ka semicircle, namarkata, la pyn-long da u diameter bad kawei ka bynta ka circumference jong ka circle ba u ot.



Lada khylliap la ka circle ha uno uno u diameter ar pyngkhoh, ngi lohi ba ki bynta jong kawei ka semicircle ki la hap thik bad ki bynta jong ka semicircle kaba ha kawei pat ka liang. Kumta ngi ong ba kano kano ka circle ka long symmetrical ha uno uno u diameter jong ka.

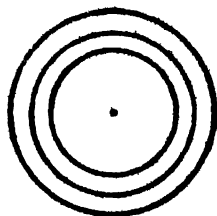
Ka arc ka long ka bynta jong ka circumference. Ka ryntieh, ka khilon, u simpyllieng ki long ki nuksa ka arc.



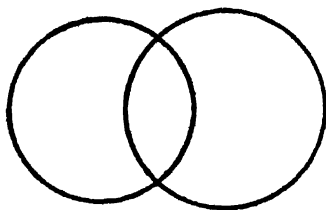
Pynlasoh la ki tduh ka arc ngi loh la u 'sai ryntieh. Ki khot la u u chord. U chord u long u line uba pynlasoh la kino kino ar tylli ki point ha ka circumference. Haba uno uno u chord u laid lyngba la ka center jong ka circle ki khot ruh la u diameter. U diameter, namarkata, lah ruh ban ong ba u long u chord uba laid lyngba na ka centre jong ka circle.

Katno tylli ki chord lah ban ring ha ka circle? Uei u chord uba jrong tam ba lah ban ring ha ka circle?

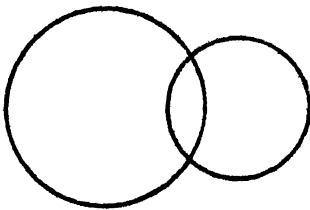
Buh dak la ka point **O** ha ka kotsada bad na ka point **O** kum ka centre ring láí tylli ki circle kiba u radius un long 1·5", 2" bad 2·3". Khmih la kine ki circumference ki la pom ne la ot kawei-la-kawei. Batai balei kim la pom?



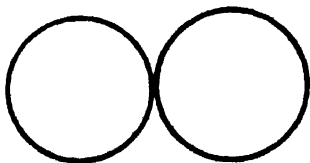
La ki circle kiba la ring na kajuh ka centre hynrei kiba la pher ki radius la khot coucetric circles.



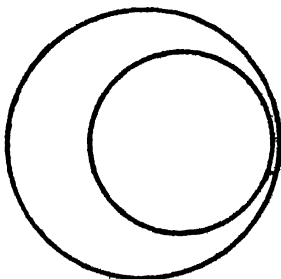
Dur 1



Dur 2



Dur 3



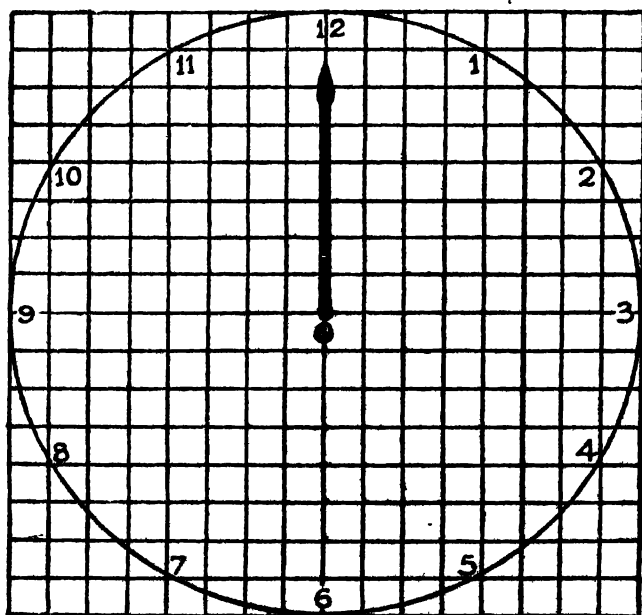
Dur 4

Peit ha kitei ki dur. Ha ka dur 1 ngi lohi ba ki circle ki la ot kawei-la-kawei pat ha ki ar tylli ki jaka. Ha ka dur 2 ki jaka ba ki la ot ki kham la jan kawei-la-kawei ban la kaba ki long ha ka dur 1. Kumta haba ki jaka ba ki circle ki la ot ki la la jan kat haduh ba ki la la hab hajuh ngi ong ba ki circle ki shu la tyngkhuh.

Ha ka dur 3 ki circle ki ia tyngkhuh na shabar; kata, kawei ka circle ka shong shabar kawei pat. Ha ka dur 4 pat ki circle ki ia tyngkhuh na shapoh; kata, kawei ka circle ka shong hapoh kawei pat.

Jingpyrshang 2

Ex. 1. Ring kawei ka circle kaba u diameter u long 3·0'', bad ha ka circumference buh dak ia ka point X. Na u X ring ar tylli ki chord, uwei uba 1·5'' bad uwei uba 2·0''. Katno ka jingjrong jong u chord uba jrong tam ha kane ka circle?



Ex. 2. Ring dur ia ka khmat baje (clock face) ha ka squared paper. Nyngkong buh dak O nangta sa ia u 3, 6, 9, 12 nangta sa ia u 1, 5, 7, 11 bad 2, 4, 8, 10.

(i) Shim ia u line 6, 0, 12 kum u line ha uba yn khylliap ia ka khmat baje ar pyngkhoh. Ki point 11, 3, 8,

2, 7 ki la háb bad kino ki point? Ka arc 1 haduh 4 kan la háb bad kanø ka arc?

(ii) Shim pat sa la u line 9 0 3 bad khylliap la ka khmat baje ha u, ar pyngkhoh. Ki point 1, 8, 5, 11 kin la hab bad kino ki point? Ka arc 11 haduh 1 kan la hab bad kano ka arc?

(iii) Shim pat sa la u line 5 0 11. Iathuh ter ter la ki point kiba la háb haba khylliap ar pyngkhoh la ka khmat baje ha une line?

Ex. 3. Ring kawei ka circle bad uwei u chord PR ha ka. Ha ki katno bynta u chord PB u pynbynta la ka circumference? Kdew la kita. Uno uno u chord u lah ne em ban pynabynta la ka circumference ha ki arc kiba la ryngkat? Uno uba kham jrong, ka arc ne u chord uba pynasoh la ki tduh jong ka?

Ex 4. (i) Shim ar tylli ki point A bad B kiba la jngai $2\frac{1}{2}$ ". Na u A kum ka centre bad da u radius uba 1" ring kawei ka circle bad na u B kum ka centre bad da u radius uba $\frac{1}{2}$ " ring sa kawei ka circle. Batai balei ba kawei ka circle ka long shabar kawei pat. Katno ka jing-jngai kaba jan tam na kawei ka circumference ha kawei pat?

(ii) Shim biang ar tylli ki point A bad B kiba la jngai 5.5 cm bad kumba la leh ha ka Exercise kaba haneng, ring kawei ka circle na u point A kum ka centre bad u radius 3.6 cm. Na ka point B pat ring circle da u radius 3 cm. Balei kine ki circle ki la pom? Ha katno tylli ki point kine ki circle ki la pom?

(iii) Sa shisien pat shim ar tylli ki point A bad B kiba la jngai 4" bad na ka point A bad B kum ki centre ring ar tylli ki circle kawei kaba u radius 3" bad kawei pat kaba u radius 1". Kine ki circle ki la pom? Ki la kynduh? Lada phi leh bniah la kane phin shem ba kine ki circle ki la tyngkhuh kawei-la-kawei pat. Hangno ki la tyngkhuh? Batai balei ki la tyngkhuh?

Ex. 5. Shim ar tylli ki point A bad B kiba la jngai 1.5 cm. Na ka centre A ring circle kaba 4.8 cm u radius bad na ka centre B ring pat kawei ka circle kaba 3.3 cm u radius. Kumno bad hangno ka circle kaba ar ka la shem bad kaba nyngkong ?

Ex. 6. Shim ar tylli ki point kiba la jngai 3"; khot ia ki A bad B. Na ka centre A bad da u radius 2.5" ring kawei ka circle. Na ka centre B bad da u radius 2" ring sa kawei pat ka circle. Jer kyrteng la ki point ha kiba ki circle ki la ot P bad R. Katno ka jingjngai u P na u A bad na u B ruh? Katno u R u jngai na u A bad u B ruh?

Ex. 7. Shim ar tylli ki point A bad B kiba la jngai 4.2 cm. Shim da u compass jong phi la ka point kaba jngai 8 cm na ka point A bad 8 cm na ka point B. Katno tylli kiba kum kita ki point phi lah ban shem? Batai kumno phi leh.

Ex. 8. Ring u line uba 1.5" ka lynter. Shem da u compass la ka point kaba jngai 1.0" na kawei-pa-kawei ka tduh u line. Katno tylli kiba kum kita ki point lah ban shem?

LYNNONG IV

KI ANGLE

Peit ha ka sla kot jong phi. Katno tylli ki rymmiang (side) ka don? Katno dong ka don? Ki dong kiba kumno phi khot la ki? Lah ban khot la ki ki dong matang (square corners).

Peit pat ha ka set square kiba ki rymmiang (side) bad ki dong jong ka kim la ryngkat. Katno dong ka don? Ki dong ha kane ka set square kim la katjuh ka jingheh. Don kawei ka dong matang. Kiwei pat ki long ki dong kiba nep. Ki khot la kine ki dong ki sharp corner.

Mynta buh ia ka dong matang ka set square jong phi ha kawei ka dong ka sla kot jong phi. Phi lohi aiu? Ki rymmiang ka set square ki ia hab thik bad ki rymmiang ka dong ka sla kot. Ka dong matang ka set square ka ia ryngkat thik bad ka dong ka sla kot.

Aiu shuh phi lohi? Ka jingjrong ki rymmiang (side) ka dong matang ka set square kim ia ryngkat bad ka jingjrong ki rymmiang ka sla kot. Hynrei ki dong pat ki ia ryngkat.

Buh pat ia ka dong matang ka set square ha kawei ka dong ka miej. Phi lohi aiu? Ki dong ki ia ryngkat hynrei ki rymmiang ki dong kim ia ryngkat. Buh pat ha kawei ka dong ka blackboard. Kumjuh hi ka long.

Ngi loh aiu nangne? Ka jingheh ka dong kam shong ha ka jingjrong ki rymmiang (side) jong ka.

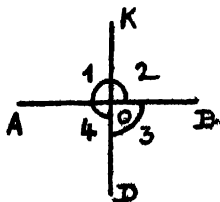
To ngin kynmaw ia kine khyndiat harum :—

Ia ka dong ki khot ka angle. (\angle u long dak uba ngi thoh lyngkot ia ka ktien angle.)

La pynlong ia ka angle da ki ar tyili ki line kiba la ring na kajuha ka point. Ia kine ki line la khot ki kti (arms) jong ka angle.

Ia ka dong matang ki khot right angle (thoh lyngkot rt. \angle).

Kaba jem ban shna rt. angle. Shim iwei i lyngkhot kotsada. Khylliap ia i ar pyngkhoh. Ka dak khylliap ka pynlong ia u line AB. Khlem da plied ia ka jingkhylliap ba la khylliap, khylliap pat sa shisien ha kata ka rukom ba ka point B kan hab ha ka point A. Plied ia ki jing-khylliap. Ka jingkhylliap kaba ar ka pynlong ia u KD. Kine ar tyili ki line ki ia pom ha ka point O bad ki pynlong saw tyili ki dong matang.



La jér kyrteng ia kine ki dong kumne :—

Ka dong 1 — AOK ne KOA.

Ka dong 2 — BOK ne KOB.

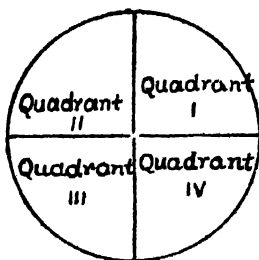
Ka dong 3 — BOD ne DOB.

Ka dong 4 — AOD ne DOA.

Phi iohi nangne ba u dak uba jér kyrteng ia ka dong u dei ka kyrteng u point ha uba ki line ki pynlong ia kata ka dong. Dei ban thoh ia u hapteng jong kita ki ar tylli ki dak kiba jer kyrteng ia ka dong.

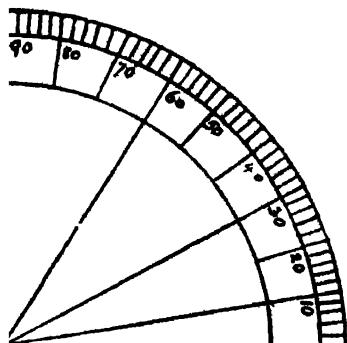
LYNNONG V

KI ANGLE—(shuh shuh)



Peit bha ha kane ka dur. La bynta ia kane ka circle ha ki sáw bynta kiba marbiang marbiang da ki ar tylli ki line kiba pynlong sáw tylli ki right angle ha ka centre. Ia kawei-pa-kawei ka bynta ki khot quadrant, (quadrant ka mut ka shi powa jong ka circle). Kumta ngi loh sáw tylli ki quadrant.

Ngi iohi ruh ba ia ka circumference la bynta ha ki sáw tylli ki arc kiba ia ryngkat.



Lada ia kawei na kine ki arc la pynbynta ha ki 90 bynta kiba marbiang marbiang bad lada pynfasoh ia iwei-pa-iwei bynta bad ka centre jong ka circle ngi iohi ba ia ka right angle la bynta ha ki 90 tylli ki angle kiba ia marbiang marbiang. Ia ka jingheh jong iwei na kine ki angle ki ong shi degree.

Ki thoh (°) na ka bynta ka ktien degree.

Kumta ngi ioh—

$$1 \text{ rt } \angle = 90^\circ$$

$$2 \text{ rt } \angle s = 180^\circ$$

$$3 \text{ rt } \angle s = 270^\circ$$

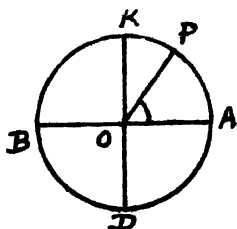
$$4 \text{ rt } \angle s = 360^\circ$$

Ia ka shi degree la bynta ha ki 60 bynta kiba ia ryngkat kiba la khot ki minute, bad ia ka shi minute pat la bynta ha ki 60 bynta kiba ia ryngkat kiba la khot ki second.

Ngi thoh da ine i dak (') la ka ktien 'minute' bad da ine i dak (") la ka ktien 'second'.

Peit pat ha kane ka dur. Lada pyntyllun ia u line OP ba un phai sawdong ha ka point O ngi lohi ba u pynlong ka angle AOP bad u OA. Kane ka angle ka long kaba nep. Ka long ka acute angle.

Lada u OP u don ha kano kano ka jaka hapoh ka quadrant I, u pynlong barobor bad u OA ki acute angle. Hynrei shisien ba u ia-bi (ia dait) bad u OK, ka angle ba u pynlong bad u OA ka long shi right angle.

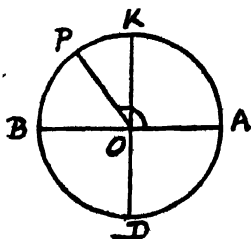


Ka acute angle, namarkata, ka dei ka angle kaba ka jingheh jong ka ka duna ia ka shi right angle (90°).

Kumta ka jingheh jong ka acute angle ka long hapteng 0° bad 90° .

Katno tylli ki acute angle lah ban thaw?

Lada nang pyntyllun ia u OP ha kata ka rukom ba u ia jam palat ia u OK, ka angle ba u pynlong ka la palat shi right angle. Kumta lada u OP u don ha kano kano ka jaka hapoh ka quadrant II, u pynlong ki angle kiba palat shi right angle. Ia kiba kum kine ki angle ki khot ki obtuse angle (obtuse ka mut ba lui; ka ia pyrshah ia ka ki ktien acute — ba nep).

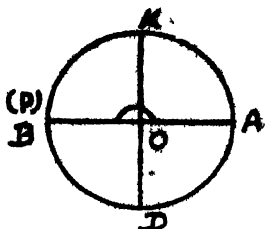


Ka obtuse angle ka long ka angle kaba palat ia ka shi right angle hynrei kaba duna ia ka ar right angle.

Ka jingheh ka obtuse angle ka long hapteng 90° bad 180° .

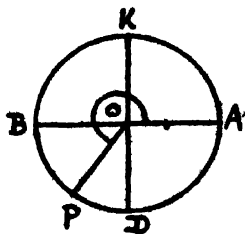
Katno tylli ki obtuse angle lah ban thaw?

Lada u OP u la-bi bad u OB ka $\angle AOP$ ne $\angle AOB$ ka long ar right angle. Ia kane ka angle ki khot ka straight angle, bad ka ia ryngkat 180° .



Nang pyntyllun shuh ia u OP-pynlong bad u OA ka la palat ar right angle. Ia kiba kum kine ki angle ki khot reflex ne re-entrant angle. Lada u OP u don ha kano kano ka jaka hapoh ka quadrant III ne IV u pynlong ki reflex ne re-entrant angle.

Ka angle ba u OP u



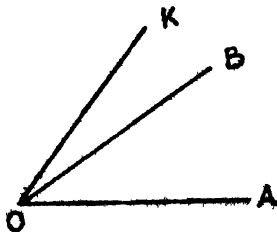
Ka reflex ne re-entrant angle ka long ka angle kaba palat ia ka ar right angle bad duna ia ka saw right angle.

Ka jingheh ka reflex angle ka long hapdeng ka 180° bad 360° .

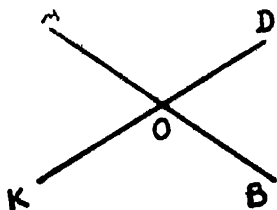
Ka dur ka angle ka long kum ka nap. Pied ia ka nap, ka dong ne angle ka nang heh. Khem ia ka nap, ka dong ne angle ka rit.

Kumta ka jingheh ka angle kam shong ha ka jingjrong ki arm kiba pynlong ia ka, hynrei ha ka jinghieng ne jingang jong ki.

Ha kane ka dur ngi tohi ar tylli ki angle, ka $\angle AOB$ bad $\angle BOK$. U OB u long u arm ia ka $\angle AOB$ bad ruh ia ka $\angle BOK$. Namarkata ia khot ia u u common arm. Ia ki angle ba la pynlong ha kane ka rukom bad uno uno u common arm ki khot adjacent angles (adjacent ka mut markhap).



Ha kane pat ka dur, ar tylli ki straight line AB bad KD ki la pom ha ka point O. Ki angle ba la pynlong ha ka point O ki long ki angle AOK, KOB, BOD bad DOA, Ki $\angle AOK$ bad $\angle BOD$ ki long kiba mar fa pyrshah. Kumjuh ruh ki $\angle AOD$ bad $\angle BOK$. La khot la kawei-pa-kawei na kine ki jur ki vertically opposite angle.



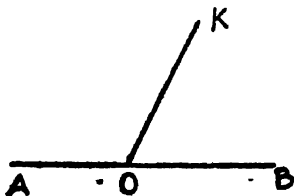
Lada ar tylli ki straight line ki la pom ki pynlong katno jur ki vertically opposite angle?

Jingpyrshang 3

1. Jér kyrteing la ki angle baroh ha kane ka dur. Kano na kine ka dei ka acute bad kano pat ka obtuse angle?

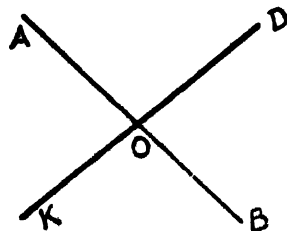
Don kano kano ka angle ka bym dei ka acute ne obtuse? Ka dei kaei?

Kino na kine ki angle ki pynlong lang ar right angle? Balei?



2. Jér kyrteing ter ter la ki angle baroh ha kane ka dur. Katno right angle ki angle baroh ha ka point O ki pynlong?

Jér kyrteing la ki acute, obtuse bad reflex angle baroh ba phi lohi ha kane ka dur.



Pyrshang ban jér kyrteing lut la ki angle ha kane ka dur.

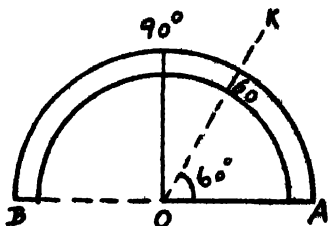
[Jingbthah : Ki nonghikai kin ring ha ka blackboard ki angle ha ki rukom shong ba pher ba pher bad kin ong la ki khynnah ban peitthuh (observe) la ki ba ki dei kiel.]

LYNNONG VI

(ANGLE *shuh shuh*)

Kaba thew ia ki angle da ka protractor

Buh ia ka pdeng ka trai ka protractor ha ka vertex ka angle ba la kwah ban thew. Khmih ba ka rymmianng ka trai kan ia-bi bad uwei u kti jong ka angle. Peit ha ka katno degre uwei pat u kti u hap. Katta kan long ka jing-heh kata ka angle ba la thew.

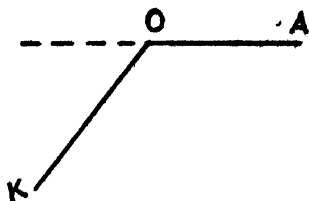


Ha kane ka dur u line AO u hap ha ka trai ka protractor bad u line OK u hap ha ka 60 degree. Ka $\angle AOK$ namar-kata ka heh 60 degree.

Jingpyrshang— Ring bún tylli ki angle — acute bad obtuse — thew ia ki.

Ban thew ia ka reflex angle.

Tharai la kwah ban thew ia ka reflex angle AOK. Thew ia ka obtuse angle AOK kumba la pyni haneng bad sa khate ia ka jingheh ka obtuse $\angle AOK$ na ka 360° . Kaba mih ka long ka jingheh ka reflex angle AOK.



Kynmaw ki angle ha ka point O ki long 4 right angles ne 360° .

Tharai.

Ka $\angle AOK = 130^\circ$

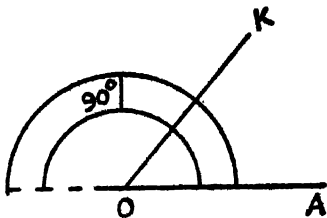
\therefore Ka reflex $\angle AOK = 360^\circ - 130^\circ$
 $= 230^\circ$

[\therefore ka mut namarkata.]

Jingpyrshang — Ring dur ia ka angle 50° , 75° , 120° , 135° , 225° , 315° (da ka protractor).

Ban ring dur ia ka angle kaba 50° .

Ring uno uno u line OA. Buh ia ka pdeng ka trai ka protractor ba kan hap ha ka point O. Khmih ba ka rymmiang ka trai ka protractor kan ia-bi bad u OA Pynjrong ia u OA lada donkam.

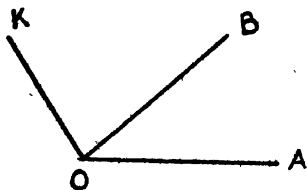


Buh dak ha ka kot-sada hamar i dak 50° ha ka rymmiang jong ka semicircle. Weng noh ia ka protractor. Pyniasoh ia ine i point bad ka point O. Jér kyrteng ia kane ka angle AOK. Ka $\angle AOK$ ka long ka 50° .

Leh kumjuh ia kitei kiwei pat.

Jingpyrshang 4.

1. Thew ia ka jingheh ka $\angle AOK$ bad $\angle AOB$. Da kaba ia khate shem ia ka jingheh ka $\angle BOK$. Thew da ka protractor ia ka $\angle BOK$. Ka ia dei ne em kumba phi la shem da kaba kheif?



2. Ring u line AB uba jrong $3''$. Na ka point A ring sa uwei u line u ban pynlong ka angle kaba 56° bad u AB.

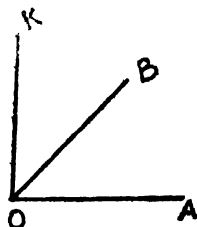
3. Leh kumjuh kum ha ka Ex. 2 bad pynlong ia ki angle ha ka point A kiba (i) 27° , (ii) 8° , (iii) 243° . Leh ia kine tang ha kawei ka dur.

4. Khlem da pyndonkam ia ka protractor ring ia ki angle kiba ka jingheh jong ki kan ia jan katba lah bad ka angle 45° , 30° , 18° , 125° , 64° , 115° , 225° . Thew ia ki jingpyrshang jong phi bad shem katno phi bakla.

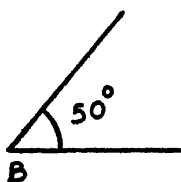
LYNNONG VII

ANGLE (*shuh shuh*)

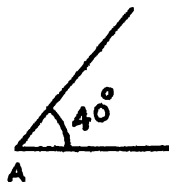
Ki complementary bad supplementary angle



Dur 1



Dur 2



Shna kawei ka right angle da ka protractor ne set square. Jer kyrteng la ka AOK. Ring u line OB hapoh ka $\angle AOK$.

Ngi lohi ba ia ka $\angle AOK$ la pynlong ruh da ki $\angle AOB$ bad $\angle BOK$.

\therefore Ka sum jong ka $\angle AOB$ bad $\angle BOK = \text{shi rt } \angle = 90^\circ$.

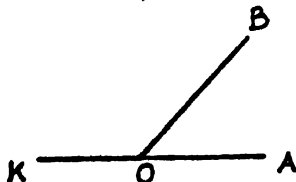
Thew ia kine ki angle da ka protractor bad khmih la ka sum jong ki ka mih ne em 90° .

Haba kino kino ar tyll ki angle ki pynlong shi right angle la kiba kum kita ki angle ki khot complementary angles. Ia kawei na ki ki ong ba ka long ka complement jong kawei pat. Complement ka mut, kata kaba pyndap ia kaba duna.

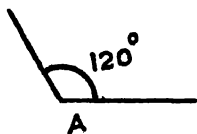
Ha ka dur 1, ka $\angle BOK$ ka long ka complement jong ka $\angle BOA$ namar ba ka pyndap ia kaba ka $\angle BOA$ ka duna na ka shi rt angle. Kumjuh ruh ka $\angle AOB$ ka long ka complement jong ka $\angle BOK$.

Ha ka dur 2 ka $\angle A = 40^\circ$ bad ka $\angle B = 50^\circ$. Ka sum jong ki ka long 90° .

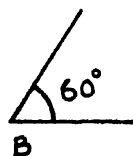
Namarkata, ka $\angle A$ ka long ka complement jong ka $\angle B$, lane, ka $\angle B$ ka long ka complement jong ka $\angle A$.



Dur 3



Dur 4



Shna kawei ka straight angle AOK bad ring u line OB ban pynlong ki angle bad u AK.

Hangne, ngi tohi ba ia ka $\angle AOK$ la pynlong da ka $\angle AOB$ bad $\angle BOK$.

\therefore Ki $\angle AOB$ bad $\angle BOK$ baroh lang = $2 \text{ rt } \angle s = 180^\circ$.

Thew ia kine ki angle da ka protractor bad khmih la ka sum jong ki ka mih ne em 180° .

Ring lai, saw tylli ki dur kiba kum kitei ha kiba u OB u don ha ki jaka ba tapher ia pher.

Thew ia ka jingheh ki angle ba u OB u pynlong bad u AK. Shem ia ka sum jong ki.

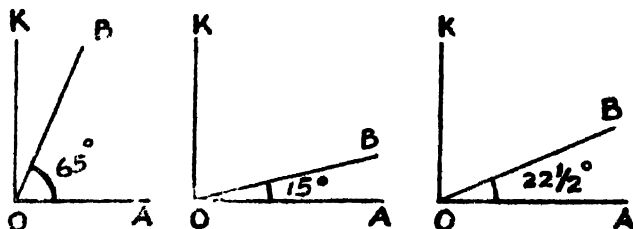
Haba ka sum jong kino kino ar tylli ki angle ka long ar right angle, ia kita ki angle ki khot supplementary angles. Ia kawei na ki ki ong ba ka long ka supplement jong kawei pat. Supplement ka mut, ka jingpyndap ia kaba duna.

Ha ka dur 3, ka, $\angle BOK$ ka long ka supplement jong ka $\angle BOA$ namar ba ka pyndap ia kaba ka $\angle BOA$ ka duna na ka ar right angle. Kumjuh ruh ka $\angle BOA$ ka long ka supplement jong ka $\angle BOK$.

Ha ka dur 4, ka $\angle A = 120^\circ$ bad ka $\angle B = 60^\circ$.
 Ka sum jong ki ka long 180° .
 \therefore Ka $\angle A$ ka long ka supplement jong ka $\angle B$.
 lane ka $\angle B$ ka long ka supplement jong ka $\angle A$.

Jingpyrshang 5

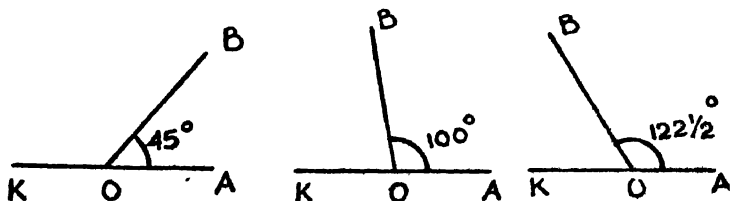
1. Haba kumno lah ban ong ba ar tylli ki angle ki long—(a) complementary (b) supplementary?



2. Ha kitei ki dur lai tylli:—

- (a) Lada ka $\angle AOB = 65^\circ$; katno ha jingheh ka $\angle BOK$?
- (b) Lada ka $\angle AOB = 15^\circ$; katno ka jingheh ka $\angle BOK$?
- (k) Lada ka $\angle AOB = 22\frac{1}{2}^\circ$; katno ka jingheh ka $\angle BOK$?

3. Wad la ka complement jong kine ki angle:—
 25° ; $37\frac{1}{2}^\circ$; 45° ; $66\frac{1}{2}^\circ$



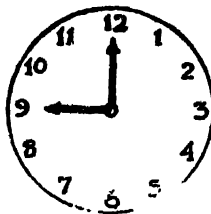
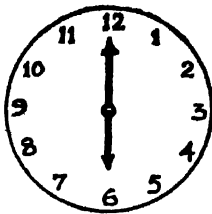
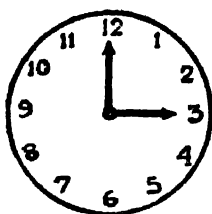
4. Ha kitei ki dur lai tylli:—

- a) Lada ka $\angle AOB = 45^\circ$; katno ka jingheh ka $\angle BOK$?
- b) Lada ka $\angle AOB = 100^\circ$; katno ka jingheh ka $\angle BOK$?
- k) Lada ka $\angle AOB = 122\frac{1}{2}^\circ$; katno ka jingheh ka $\angle BOK$?

5. Wad la ka supplement jong kine ki angle:—
 $22\frac{1}{2}^\circ$; 30° ; 60° ; 115° ; 145°

LYNNONG VIII

KA JINGKHEIN IA KI ANGLE NA KI KTI BAJE



Peit ha kitei ki dur.

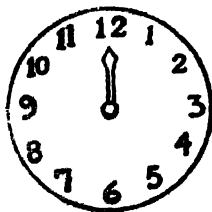
Ha ka por 3 baje thik, ki kti baje ki pynlong ka angle kaba katno degree? Ha ka por 6 baje, 9 baje, 12 baje ki pynlong ki angle kiba katno degree?

Ki kti baje katba ki laid bad pyni la ka por ki pynlong artat la ki angle.

U kti baje uba kdew la ki minit (minute hand) u laid kham stet ban la u kti baje uba kdew la ki kynta (hour hand).

To ngin la peit mynta la ka jinglaid u minit hand.

U minute hand u shim por 60 minute ban tawiar shisien tawiar la ka lyngwiar ka khmat baje. Kumta u laid 360° ha ka shisien tawiar.



Kumta lada ha ka 60 minit u minute hand u laid 360°
 \therefore " 1 " " " " $= 360^\circ \div 60$
 $= 6^\circ$

Lane, lah ban ong kumno—

Ha ka shi minute u minute hand u pynlong ka angle kaba 6° .

Jubab ia kine mynta—

U minute hand un pynlong ka angle kaba katno degree ha ka—

(a) 5 min; 10 min; 20 min; 40 min; 50 min bad $7\frac{1}{4}$ min.

(b) 15 min; 30 min; 45 min; $22\frac{1}{4}$ min.

Ban wád ia ka por ba u minute hand u laid ban pynlong ia ka jingheh ka angle ha ki degree ba la ai.

Ngi lohi ba,

Lada ka jingheh ka angle ka long 6° u minute hand u shim
 por ban laid—1 min
 \therefore „ „ „ „ 1° „ $\frac{1}{6}$ min

Kumta lada ka jingheh jong ka angle ka long X° (u X u teng ia kano kano ka jingheh) ka por ba u minute hand u shim ban pynlong ia kata ka angle $= \frac{1}{6}$ jong u X .

Jubab ia kine:—

Katno kan shim por ia u minute hand ban pynlong ia kine ki angle:—

60° ; 90° ; 120° ; 180° ; 240° ; 270° ter ter.

Nuksa—

Ban pynlong ka angle kaba 60° u minute hand un shim por $\frac{1}{6}$ jong u X ; kata $\frac{1}{6}$ jong ka $60^\circ = 10$ min.

Jingpyrshang 6

1. Ring dur ia ka khmat baje (clock face) ha ka squared paper.

Nyngkong buh dak **O** ; nangta sa ia u 3, 6, 9, 12; nangta sa ia u 1, 5, 7, 11 bad 2, 4, 8, 10.

(i) Katba u kti baje u tyllun sawdong na u 12 u pynlong ka angle kaba heh katno ha u (a) 3, 6, 9, 12 (b) 1, 2, 4, 5 (k) 7, 8, 10, 11.

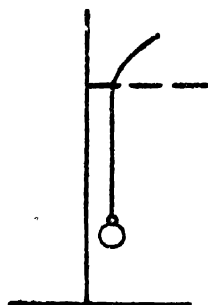
(ii) Katno ka jingheh ka angle ba la pynlong da ki ar tylli ki kti baje ha ka por 2 baje, 5 baje, 7 baje, 11 baje bad shi baje shiteng.

(iii) Katno minit u minute hand un laid ban pynlong 30 degree bad u line 9 0 3 ha ka point O ? 60 degree?

LYNNONG IX

KI VERTICAL BAD HORIZONTAL : KI PERPENDICULAR BAD PARALLEL

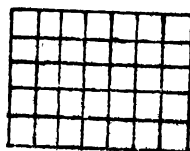
Teh la kano ka kynja ba khia kum ka lyngkhot sisa ne rynnong ha tduh jong uwei u ksai bad pynhab la kata ka jingkhia da kaba bat na kawei pat ka tduh jong u ksai. Ngi iohi ba uta u ksai lem bad kata ka jingkhia u hab beit thik. Ia uta u ksai lem bad ka jingkhia ba la teh ha tduh jong u bad ba la pyndonkam ha kane ka rukom la khot u sawar. Lada pynhab bun tylli ki sawar ki line ba ngi ioh nangta ki long vertical lines. Tharai baroh phi la ju iohi la u sawar. Hangno? Bad kumno ia pyndonkam ia u?



Ia u line uba pynlong ki right angle bad uno uno u vertical line ki khot horizontal.

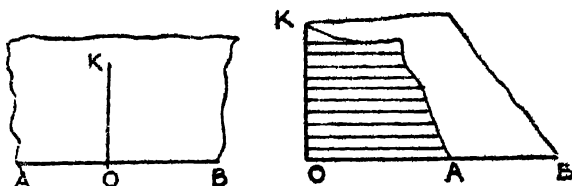
Ia ki veritcal line la khot ki line pynleng bad ia ki horizontal line la khot ki line pyngkiang.

Kdew la ki line hapoh la kamra skul kiba long vertical bad horizontal.



Ka angle kaba katno degree u vertical line u pynlong bad u horizontal line?

KI PERPENDICULAR



Dur 1

Dur 2

Shim kawei ka lyngkhot kotsada kaba kawei na ka rymmiang jong ka ka long kaba beit bha (kum ha ka dur 1).

Jér kyrteng la kata ka rymmiang AB.

Khylliap la kata ka kotsada ar pyngkhoh ha kata ka rukom ba u point A un háb ha kano kano ka point ha kata ka rymmiang (dur 2).

Plied la kata ka jingkhylliap. Jér kyrteng la kata ka dien khylliap OK. Thew la ka jingheh ka $\angle AOK$ bad $\angle BOK$.

Phi shem kumno? Ki la ryngkat ne ém?

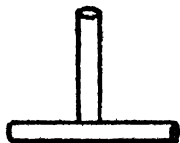
Leh búnsien la kane da kaba khylliap la ki kotsada ha ka rukom ba la pyni haneng. Phin shem ba u OK u pynlong ki right angle bad u line AB ha kawei-pa-kawei ka liang jong u.

Laida uno uno u line u pynlong ki right angle bad uwei pat u line, la uta u line ki ong ba u ieng beit thik (perpendicular) halor uta uwei pat u line.

Shim pat. ar tylli ki dieng. Pynleng la uwei u dieng halor uwei pat. Lada u thiah shiliang kum ha ka dur 3, ki angle ba n pynlong kim la ryngkat Kumta um ieng perpendicular halor uta uwei pat u line.



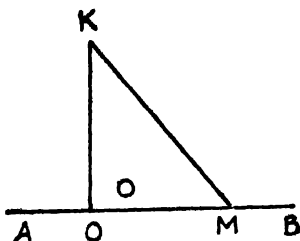
Dur 3



Dur 4

Hynrei lada um thiah shiliang (dur 4) u pynlong ki angle kiba la ryngkat, kawei kawei na ki ka long shi right angle bad u ieng perpendicular halor uta uwei pat u line.

Shim pat la ka set square,
pynleng la ka halor u line AB
ha kata ka rukom ba kawei ka
rymmiang kan₃ la ₁ háb bad u
line AB.



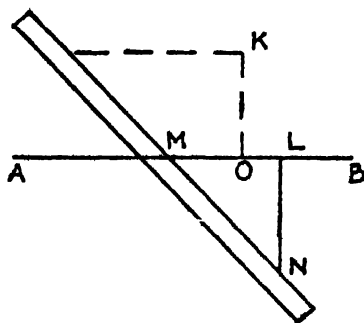
Phi fohi ba kata kawei pat
ka rymmiang ka leng beit thik
halor u line u AB.

*Ban ring ia u line uba leng perpendicular halor uwei pat u line
da u ruler bad ka set square.*

Ring uno uno u line AB bad buh dak la kano kano ka
point O ha u.

Buh la u flat ruler
ha ka rukom ba la pyni ha
ka dur.

Shim la ka set square
bad tyngkhap la ka rym-
miang kaba pyrshah la ka
dong matang ha ka rym-
miang u flat ruler ha kata
ka rukom ba kawei na ka
rymmiang jong ka set
square kan háb ha u line
AB. Kata ka set square
kan shong ha ka jaka
LMN ha ka dur.



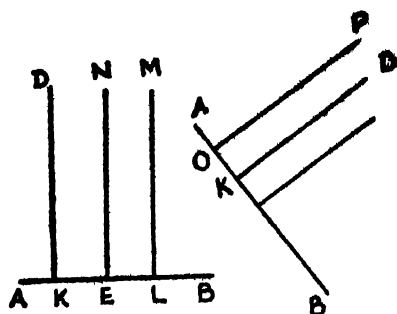
Khyññiat la ka set square haduh ba ka point O kan
don ha kawei pat ka rymmiang jong ka set square kumba
la pyni ha ka dur.

Shim da u let uba nep bad ring ia line OK. U OK
mynta u leng perpendicular ha u line AB.

Wat bakla ia u vertical bad perpendicular.

Ki line **KD**, **EN**, **LM**,
ki long ki vertical line
bad ki feng perpendicular
ha u line **AB**.

Hynrei ki line **PO** bad
DK kim long vertical
la ki feng perpendicular
ha u line **AB**

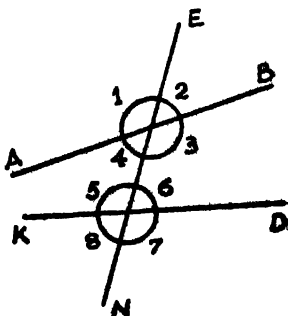


KI PARALLEL.

Ring ar tylli ki line **AB** bad **KD**. Ring sa uwei u line
EN u ban ot ia kine ki line.

Ngi lohi na kane ka dur ba
kine ki line ki pynlong 8 tylli ki
angle.

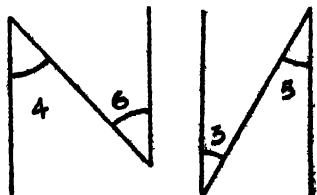
Ia ki angle 1 bad 2 ; 7 bad 8
ki khot external angles (ki angle
kiba shabar). Ia ki angle 3 bad
4; 5 bad 6 ki khot internal angles
(ki angle kiba shapoh).



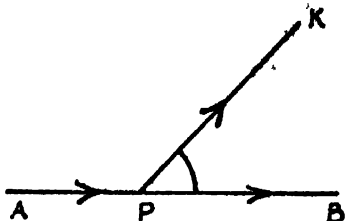
Na ki angle 2 bad 6, kaba 2
la ong ba ka long ka external
angle bad kaba 6 ka long ka interior opposite angle. Ki ju
khot ia kiba kum kine ki angle corresponding angles.

Ia ki angle 4 bad 6 ki khot alternate angles (ki khong-
dong kiba la phai pyrshah).
Kumjuh ruh ki angle 3 bad 5
ki dei ki alternate angle.

Ia ka phang u straight
line la pynshai (determine) da
ka angle ba u pynlong bad u
line of reference.



Tharai uwei u briew u laid ha kawei ka surok kaba beit siak na ka point A sha ka point B ; bad tharai ynda u poi ha ka point P u kdat noh sha kawei pat ka lynti kumba la pyni ha kane ka dur.



U line AB u kdew la ka phang ka jinglaid jong u ha ka sien kaba nyngkong bad u line PK la ka phang ka lynti ba u kdat. Ia ka phang ba u kdat na ka lynti ba u laid mynnyngkong la pyni da ka $\angle BPK$, kata, ka angle ba la pynlong da ka lynti thymmai bad ki lynti kaba un dang laid lada um shym kdat shawei pat.

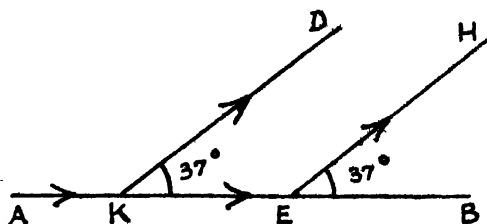
Ring dur kumba leh haneng ban pyni ia kine harum :—

1. Ka jhad kaba laid beit shaphang mihngi ynda ka la laid katto katne ka kdat 45° shaphang shatei na ka phang ba ka laid mynnyngkong. Buh dak ia ka angle kaba pyni ia ka phang ba ka kdat ka jhad bad ia ka phang ba ka laid nyngkong.

2. U briew u laid beit shaphang shatei. Ynda u la laid katto katne u kdat 90° shaphang mihngi na ka phang ba u laid. Ring dur kumba phi leh ha ka jingpyrshang 1.

Tharai pat,

Ar ngut ki briew ki laid na u A sha u B. Uwei ynda u la poi ha ka point K u kdat 37° shaphang kadiang u da laid noh na u line KD. Uwei pat u nang laid la ka laid bad ynda u poi ha ka point E u ruh u kdat 37° shaphang kadiang hi, u da bud ia u line EH. Phi tharai ba kine ki briew kin la shem?



Peit ha kane ka dur bad jubab la kine ki jingkylli—

(a) Kine ki lynti thymmai ki la kynduh ne em?

(b) Kin la shem ne em lada pynjrung la ki sha khmat ne shadien?

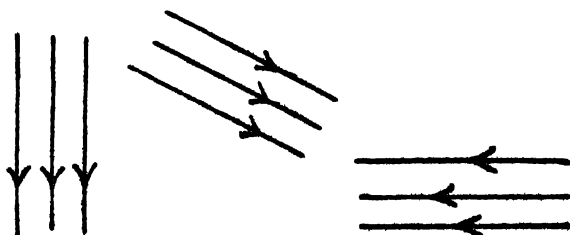
(k) U briew uba laid na ka lynti ba la pyni da u KD un dang la shem ne em bad uto uba laid ha ka lynti EH. Balei? Namar kine ki briew ki kdat sha ki phang kiba pynlong ki angle kiba katjuh bad u AB.

Ia kiba kum kine ki line ki bym la shem ne la kynduh lada pynjrung katno katno ki khot **parallels**.

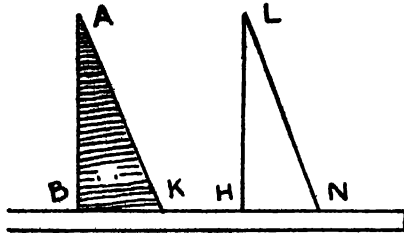
Tharai pat mynta nga ring uwei u line halor miej bad uwei pat ha madan. Kine ki line kin la shem lada pynjrung la ki? Lah ban ong ba ki long parallel? Balei?

Ki line ki dei ban don ha kajuh ka sla (surface) bad ring sha kajuh ka phang khnang ba lah ban ong la ki ba ki long parallel.

Ki **parallel line** ki long ar ne bun tylli ki line kiba la ring sha kajuh ka phang bad ha kajuh ka sla kiba ym lah ban la shem lada pynjrung la ki katno katno.



Ban ring ia ki parallel da ka set square bad u flat ruler.



Buh ia ka set square ha kano kano ka jaka kumba ia pyni ha katei ka dur ba la pynlong.

Tyngkhap ia u flat ruler ha kawoi na ki rymmiang ka set square kiba pynlong ia ka rt angle.

Bat skhem ia u ruler ba un ym khlih bad ruid line ia kiwei pat ki rymmiang ka set square.

Pysyntuid ia ka set square halor u ruler haduh ban da poi ha ka jaka ba la pyni da ka dur LHN.

Ruid line ia ki rymmiang ka set square hangne ruh.

Kdew kino ki line kiba ia long parallel bad balei?

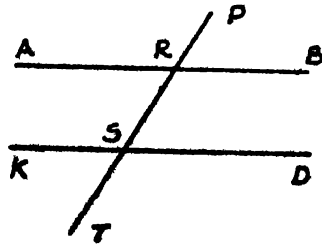
Katno tylli ki line lah ban ring ha kajuh ka sla kiba ia long parallel uwei-ia-uwei pat?

Jingpyrshang 7

1. Ring ar tylli ki parallel straight line AB, KD. Ring sa uwei u line PRST u ban pom ia ki ha u R bad u S.

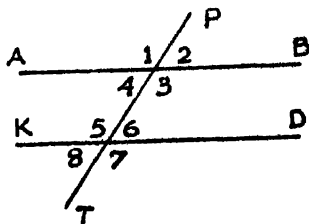
Jér kirteng ia ki angle ba une u line u pynlong bad u AB bad KD.

2. Thew ia ka jingheh kitei ki angle bad jér kirteng ia kito kiba ia ryngkat ka jingheh.



3. Pyndonkam da ki set square ban ring la ki parallel line AB bad KD. Ring sa uwei u line PT ban pom la ki.

Jér kyrteng fa ki angle kumba la pyni ha kane ka dur



(i) Kdew fa ki saw jur ki corresponding angle. Thew fa ka jingheh jong ki. Kaei ka jingladei ki shi jur ki corresponding angle ha ka jingheh? shem na kane.

Kynmaw bha fa kaba phi

(ii) Kdew lut fa ki alternate angle. Thew fa ki jingheh jong ki. Aiu phi shem na kane? Kynmaw bha fa kane ruh.

(iii) Thew fa ka jingheh ki interior angle kiba fa shong sha kajuh ka liang u PT. Adlang fa ki. Katno ki mih? Kynmaw bha fa kane ruh.

(iv) Jér kyrteng R bad S fa ki point ba u PT u ot fa u AB bad KD Ruid dur da ka kot shini (tracing paper) fa kane ka dur Pynsyntuid fa ka kot shini ha kata ka rukom ba u line PT un hab ha ka jaka ba u don mynshuwa haduh ba ka point R kan fa háb bad ka point S. Hangno ka dak ruid u AB ka háb mynta? Pynshisha nangne fa kaba phi shem na (i) bad (ii).

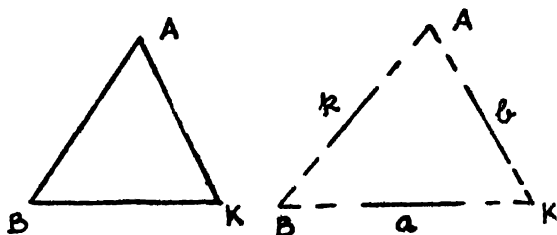
Pynkylla khongpong fa ka dur ba phi ruid ha ka kot shini kumta ba u S un háb ha u R bad u R ha u S. Hangno u AB bad KD kin fa hab mynta? Pynshisha fa kaba phi shem na (ii).

(v) Thoh fa ki jingringnia ba phi ioh na kitei ki 3 tylli ki jingshem ba phi shem na ki jingpyrsang jong phi. Kynmaw bha fa ki.



LYNNONG X

KI DUR LAI DONG (TRIANGLE)



Shim láí tylli ki point A, B, K ki bym ía don ha ujuh u straight line. Pynfasoh AB, BK, KA. Ka dur aiu phi loh ?

Shim pat láí tylli ki straight line a, b, k ki bym ía long parallel uwei-ía-uwei pat. Pynjrong ía ki haduh ba kin da ía shem uwei-ía-uwei pat. Ka dur aiu phi loh ?

Ha baroh ar kitei ki jingring dur ngi loh ía ki dur láí dong. Ía ki dur láí dong ki khot ki triangle. [Tri ka mut láí ; angle ka mut dong.]

Ka triangle, namarkata, ka long ka dur ba ía kér kut da ki láí tylli ki side. Ka don láí tylli ki side bad láí tylli ki angle. Ía ki point ha kiba ki ía kynduh ki side ki khot vertices.

Ía u side ha uba ka triangle ka íeng ki khot base.

Ka sukum thoh lyngkot ía ka ktien triangle = \triangle .

La jér kyrteng ía kitei ki triangle ABK. Ki 3 tylli ki angle kane ka triangle ki long ABK, BKA bad KAB. Lah ban ong lyngkot ía ki kumne :—

Ka $\angle A$ ía ka angle ha ka point A.

Ka $\angle B$ " " " B

Ka $\angle K$ " " " K.

Ki 3 tylli ki side jong ka triangle ki long AB, BK, KA. La ju khot ruh fa ki kumne :— a fa u side uba pyrshah fa ka $\angle A$; b fa u side uba pyrshah fa ka $\angle B$, bad k fa u side uba pyrshah fa ka $\angle K$.

Haba ring dur fa ki triangle don na ki kiba ki side baroh lai ki fa ryngkat, don pat kiba tang ar tylli na ki ki fa ryngkat bad don pat kiba baroh lai ki side kim fa ryngkat.

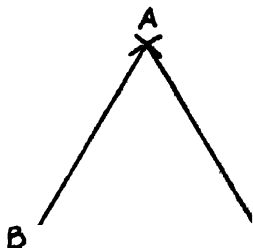
Ban ring dur fa ka triangle kaba baroh ki side ki fa ryngkat.

Shim fa u line BK uba $1\frac{1}{4}$ " ka jingjrong. Shim fa ka point B bad K kum ki centre bad da u radius uba fa ryngkat bad u BK, ring ar tylli ki arc kiba fa pom ha ka point A.

Pynlasoh AB bad AK. Ngj
loh fa ka $\triangle ABK$.

Thew mynta fa ki side jong ka. fa kiba kum kine ki jait triangle ki khot equilateral \triangle .

[equi ka mut fa ryngkat ;
lateral ka mut side.]



Ka equilateral triangle ka long ka triangle kaba baroh ki side jong ka ki fa ryngkat.

Thew pat fa ka jingheh ki angle jong kane ka triangle da ka protractor. Thoh fa ka jingheh kawei-pa-kawei ka angle ha ki degree. Thew ruh fa ka jingheh ki angle da kaba ot dur ha ka kotsada. Aiu phi lah ban ong shaphang ki angle?

Thoh—

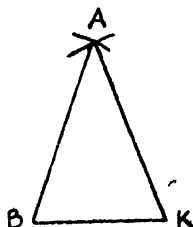
Ka sum jong 3 tylli ki angle ka $\triangle ABK$ —

Kynmaw ruh fa kane ka jingshisha—

Haba baroh ki side jong ka triangle ki fa ryngkat, ki angle ruh ki fa ryngkat.

Ban ring dur ia ka triangle kaba ar tylli ki side ki ia ryngkat

Shim ia u side BK uba jrong $1\frac{1}{4}$ " kum ka base. Shim ia ka point B bad K kum ka centre bad da u radius uba $1\frac{3}{4}$ " ring ar tylli ki arc ki ban ia pom kawei-ia-kawei pat ha ka point A.



Pynlasoh AB, AK.

Ka $\triangle ABK$ ka long ka triangle kaba ar tylli ki side jong ka ki ia ryngkat.

Ia kiba kum kine ki jait triangle ki khot isosceles triangle. Ia u line BK ki khot ka base bad ia ka point A ka vertex.

Ka isosceles triangle ka long ka triangle kaba ar tylli na ki side jong ka ki ia ryngkat.

Thew da ka protractor bad da kaba ot dur ha ka kotsoda ia ka jingheh ki angle kiba ka base ka pynlong bad kiwei pat ki side jong ka triangle. Phi shem au? Ia kine ki angle ki khot base angle.

Thew ruh ia ka jingheh ka angle ha ka point A. Ia kane ka angle ki khot vertical angle.

Thoh—

Ka sum jong ki 3 tylli ki angle ka $\triangle ABK = \dots\dots\dots$

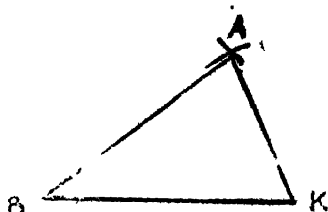
Kynmaw ruh ia kane ka jingshisha—

Ki angle ha ka base jong ka isosceles triangle ki ia ryngkat.

Ban ring dur ia ka triangle kaba ki side baroh lai kim ia ryngkat.

Shim ia ki side AB, BK, KA kiba jrong 1.4," 1.8" bad 1" tor tor.

Ring u line BK uba jrong 1.8". Shim la ka point B kum ka centre bad da u radius uba 1.4" ring kawei ka arc. Shim pat la ka point K kum ka centre bad da u radius uba 1" ring ka arc ka ban la pom bad ka arc ba la ring mynshuwa ha ka point A.



Pynlasoh AB bad AK.

Ka $\triangle ABK$ ka long ka triangle kaba ki side baroh kim la ryngkat.

Ia kiba kum kine ki triangle ki khot scalene triangle.

Ka scalene triangle ka long ka triangle kaba baroh ki side jong ka kim la ryngkat.

Thew la ka jingheh ki angle ha kane ka triangle (da ka protractor bad ot dur ha ka kotsada).

Thoh—

Ka sum jong ki 3 tylli ki angle jong ka $\triangle ABK = \dots$

Kano ka angle ha kane ka triangle kaba heh tam? Kano kaba rit tam?

Uno u side uba jrong tam? Uno uba lyngkot tam?

Kynmaw la kane ka jingshisha—

Ha ka triangle, ka angle kaba heh tam ka la pyrshah la u side uba jrong tam bad ka angle kaba rit tam ka la pyrshah la u side uba lyngkot tam.

Lah ruh ban ong kumne.

Ha ka triangle, u side uba jrong tam u dei uba la pyrshah la ka angle kaba heh tam bad u side uba lyngkot tam u dei uba la pyrshah la ka angle kaba rit eh.

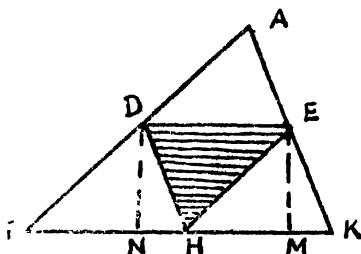
Pynshisha da kaba shua dur (experimental proof) ba ki angle ka triangle ki ia ryngkat 2 rt. angles

Ring dur kawei ka triangle kaba ki side ki long 2", 3" bad 4".

Ot marshiteng la ki side AB bad AK ha ka point D bad E.

Pynlasoh DE.

Ot la kane ka \triangle bad khylliap la ka ha u line DE. Khylliap ruh ha u line DN bad EM.



Phi fohi mynta ba la ki 3 tylli ki angle ka $\triangle ABK$ la pynlong ha ka point H. Katno ka sum jong kine ki 3 tylli ki angle? Kine ki angle ki dei ka $\angle A$, $\angle B$, bad $\angle K$.

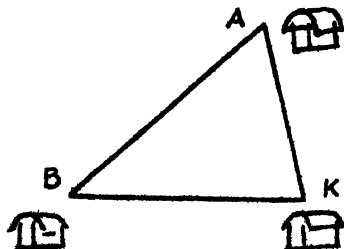
Ha kawei na kitei ki lai tylli ki jingpyrshang ngi shem ba ka sum jong ki 3 tylli ki angle jong ka triangle = 2rt \angle s ne 180° .

Hangne ruh la pyni ba ki 3 tylli ki angle ka $\triangle ABK$ = 2rt \angle s ne 180° . Kynmaw la kane.

Jingpyrshang 8

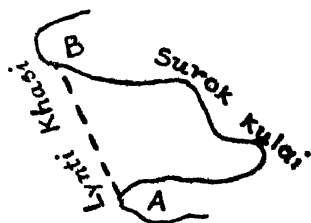
1. 3 tylli ki ling ki don ha ki 3 tylli ki jaka A, B, K kum ha kane ka dur.

Tharai lada nga kwah ban leit na ka ling B sha ka ling K, kan kham jan ban laid na ka ling B sha ka ling A bad nangta pat sha ka ling K ne ban shu laid beit na ka ling B sha ka ling K?



Nangne ngi lohi ba — *kino kino ar tylli ki side jong ku triangle baroh ar ki kham jrong ban la uba lai.*

2. Ka point A ka long kawei ka jaka ha kawei ka surok kulai bad ka point B ka long kawei pat ka jaka ha kajuh ka surok.

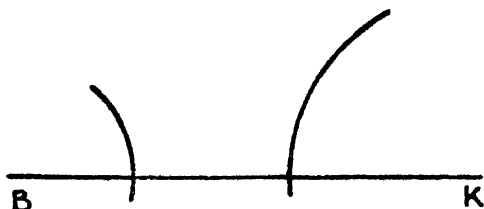


Ha kane ka dur, kham jan ban laid na ka point A sha ka point B na ka surok kulai ne lynti khasi?

Hangne ruh ngi lohi ba—

Kino kino ar tylli ki side jong ka triangle baroh ar ki kham jrong ban la uba lai.

3. Shna ka triangle kaba ki side jong ka ki long 1", 3", 5".



Ring uwei u line BK uba 5".

Na ka point B kum ka centre bad da u radius uba 1" ring kawei ka arc.

Na ka point K kum ka centre bad da u radius uba 3" ring sa kawei ka arc.

Phi lohi aiu? Balei ba ki arc kim la pom?

Ka jingjrong jong ki radius jong ki circle ba la ring na ka centre B bad K baroh ar ka duna la ka jingjrong u BK.

Nangne ngi lohi ba, khnang ba lah ban shna triangle, ka jingjrong kino kino ar tylli ki side ba la ai ka dei ban kham jrong ban la uba lai.

LYNNONG XI

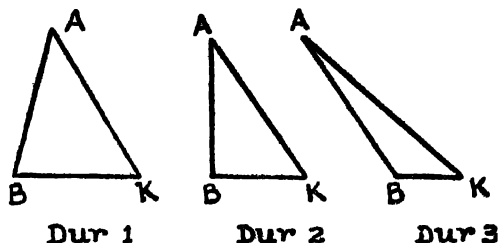
KI DUR LAI DONG (*shuh shuh*)

Ngi lohi mynta ba don lai jaid ki triangle—

(1) ka equilateral triangle (2) ka isosceles triangle (3) ka scalene triangle. La pynlabynta jaid la ki triangle kumne kat kum ka jinglaryngkat ne jingbymlaryngkat ki side ka triangle.

Mynta pat to ngin la peit la ki dong jong ka triangle.

Peit ha kine ki dur harum.



Ngi tip ba ka sum jong ki 3 tylli ki angle ka triangle ka long 2 rt \angle s ne 180° .

Thew la ka jingheh ki angle ha kawei-pa-kawei na kitei ki triangle.

Ha ka dur 1, ngi shem ba ka jingheh kawei-pa-kawei ka angle ka duna la ka shi rt. \angle .

Ha ka dur 2, kawei na ki angle ka long shi rt \angle .

Ha ka dur 3, kawei na ki angle ka palat la ka shi rt \angle .

Ki triangle kiba kum ha ka dur 1, ki khot acute-angled triangle.

Ka acute-angled triangle ka long ka triangle ha kaba baroh ki angle ki long acute.

Ki triangle kiba kum ha ka dur 2, ki khot right-angled triangle.

Ka right-angled triangle ka long ka triangle ha kaba kawei na ki angle ka long ka right angle.

Ki triangle kiba kum ha ka dur 3, ki khot obtuse-angled triangle.

Ka obtuse-angled triangle ka long ka triangle ha kaba kawei na ki angle ka long ka obtuse angle.

Kumta ngi loh sa lai jaid pat ki triangle kat kum ki angle.

Ha ka right-angled triangle, u line uba la pyrshah la ka right angle ki khot hypotenuse.

La u line uba pyniasoh la ka vertex bad ka pdeng jong u line uba la pyrshah ha ka triangle ki khot median.

Jingpyrshang 9

1. Shna kawei ka isosceles triangle ha ka base kaba 4 cm. Thew la ka jingheh ki angle ha ka base. Phi shem jingshisha aiu nangne?

2. Katno degree ka jingheh kawei-pa-kawei ka angle jong ka equilateral triangle? Ai nia da kaba shai.

3. Ha ka isosceles triangle, ka vertical angle ka long 42° ong la ka jingheh ki angle ha ka base kawei-pa-kawei. Ai nia.

Lada kawei ka angle ha ka base ka isosceles triangle ka don 42° , katno ka jingheh ka vertical angle?

4. Ha ka scalene triangle ar tylli na ki angle ki long 70° bad 38° : ka angle kaba lai ka heh katno?

5. Ha ka base kaba 6 cm ka jingjrang, ring dur la ka tr angle kaba kiwei pat ki side ki long 1.5 cm bad 3.5 cm

Lah ban shna triangle da kine ki jingthew? Lada ym lah balei?

6. Ha ka acute-angled triangle don katno tylli ki acute angle?

7. Ha ka right-angle triangle don kawei ka right angle. Lah ban don sa kawei ka rt. angle? Balei?

Katno ka sum ki ar tylli kiwei pat ki angle ka right-angled triangle?

8. Ha ka obtuse-angled triangle don kawei ka obtuse angle. Lah ban don sa kawei? Balei?

Katto katne hi mat ba kongsan ban kyamaw

1. U straight line u long ka jingjngai ba lyngkot tam na ki ar tylli ki tduh jong u.

2. I point i long tang i dak rit ba la buh dak la ka jaka. Im don jingheh.

3. Ia ka angle la pynlong da ki ar tylli ki line kiba ia shem ha i point.

4. Lada ar tylli ki line ki ia pom, ki angle kiba mar pyrshah ki ia ryngkat.

5. Ka right angle ka don 90 degree.

6. Ia ka circle la ker da u line uba khun uba ka jing-jngai kawei-pa-kawei ka point ha u na ka centre ka long katjuh.

7. Ka circumference ka long u line uba ker kut ia ka circle.

8. U radius u long u line ba la ring na ka centre sha ka circumference.

9. U diameter u long u line na ka circumference sha ka circumference lyngba ka centre.

10. Ka arc ka long ka shi bynta jong ka circumference.

11. Uwei u straight line la ong ba u long perpendicular halor uwei pat lada uta u straight line u pynlong ar tylli ki right angle bad uta uwei pat.

12. U vertical line u long u line ba la pynhab sawar.

13. Ki parallel line ki long kiba la don ha kajuh ka sla, la laid sha kajuh ka phang bad ki bym lah ban la kynduh lano lano ruh.

14. Ka triangle ka long ka dur kaba la ker da ki lai tylli ki side.

15. Ka equilateral triangle ka don lai tylli ki side kiba la ryngkat.

16. Ka isosceles triangle ka don ar tylli ki side kiba la ryngkat.

17. Ka scalene tringle ka don lai tylli ki side ki bym la-ryngkat.

18. Ka sum jong ki lai tylli ki angle ka triangle ka long 2 rt. \angle s.

19. Kino kino ar tylli ki side jong ka triangle baroh ar ki kham jrong ban la uba lai.

20. Ka obtuse-angled triangle ka don kawei ka obtuse angle ha ka.

21. Ka right-angled triangle ka don kawei ka rt. angle ha ka.

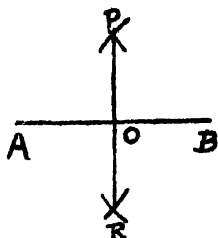
22. Ka acute-angled triangle ka don lai tylli ki acute angle ha ka.

LYNNONG XII

BAN OT IA KI LINE BAD PHIAH IA KI ANGLE

PROBLEM 1

Ban ot ia u straight line AB marshiteng, da u ruler bad compass.



Ring ia u straight line AB uba jrong antad kumba 3 cm ne 4 cm.

Jingshna dur — Shim ia u compass bad pied ia u haduh ba ka jingjingai ki tduh jong u kan palat ia ka shiteng u AB antad.

Na ka centre A bad da uta u radius ring ar tylli ki arc kawei sha kawei ka liang u AB.

Na ka centre B bad da ujuh u radius ring sa ar tylli ki arc ki ban ia pom bad ki arc ba la ring mynshuwa ha ka point P bad R.

Pynlasoh ia u PR bad buh dak O ha ka point ba u PR u ot ia u AB.

Ia u line AB la ot marshiteng ha ka point O.

Jingpynshiba—1. Shim ia u divider bad thew na u A ha u O bad na u O ha u B. Khmih ki ia ryngkat ne em? Lada ki ia ryngkat, ia u AB la ot marshiteng ha ka point O.

2. Buh dak ha ka kot shini (tracing paper) la ki point A, B bad O. Khylliap la ka kot shini kumta ba u A un hab ha u B ne u B ha u A. Hangno ka point O ka don? Ka point O ka dei ban don ha ka dak khylliap la ka kot shini. Lada ka don hangta ka pyni ba la u line AB la ot marshiteng ha ka point O. Ka jingjngai na u A ha u O ka la ryngkat bad ka jingjngai na u O ha u B.

3. Lada ki arc ba la ring na ka centre B da u radius uba kham jrong ban la u radius ki arc ba la ring na ka centre A, ka point O kan long ka pdeng jong u line AB? Lada kam long, ka point O kan khamjan sha kano ka tduh u line AB?

Thew la ki angle POA bad POB. Katno ka jingheh jong ki? Ngí shem ba u PR u pynlong ki right angle bad u AB ha ka point O. Kumta nalog ba u PR u ot la u AB marshiteng u leng perpendicular ha u AB.

Lada phi ring bún tylli ki line lyngba ka point O kine ki line ki shu ot marshiteng la u AB hynrei kim long perpendicular ha u AB. Tang u PR uba ot la u AB marshiteng bad u leng perpendicular ruh ha u. Ngí ong ruh, namar kata, ba u PR u bisect la u AB at right angles.

Jingpyrshang 10

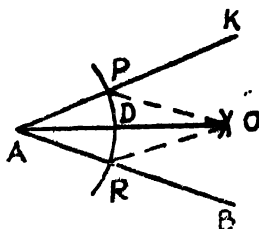
1. Haba ot marshiteng la u line AB, balei ngí shitt la u radius ba un long palat la ka marshiteng u AB? Kan long kumno lada u radius u duna la ka shiteng u AB, lane, u long shiteng thik la u AB? Pyrshang la kane.

2. Ring u line uba jrong 3.4 cm. Shem la ka pdeng jong u da kaba thew bad jér kyrteng la kata ka point O. Ot la u marshiteng da u ruler bad compass. Kumno phi shem? U line uba ot marshiteng la u line ba la ai u laid lyngba ne em na ka point O?

Ring ki line kiba jrong $2\frac{1}{4}"$; $3\frac{1}{8}"$; $2\frac{1}{2}"$; $3\frac{1}{4}"$. Ot marshiteng la ki uwei-pa-uwei bad thew la kaba phi la leh da u divider.

PROBLEM 2

Ban phiah ar liang marbiang ia kano kano ka angle, da u ruler bad compass.



Ring ia ka dur ka $\angle BAK$. La kwah ban phiah ar liang marbiang ia kane ka angle.

Jingshna dur—Na ka centre A bad da uno uno u radius ring kawei ka arc ka ban ot ia u AK bad AB ha ka point P bad R.

Na ka point P kum ka centre bad da u radius uba palat ia ka marshiteng ka jingjingai na u P ha u R ring kawei ka arc.

Na ka point R kum ka centre bad da ujuh u radus ring ia ka arc ka ban ot ia ka arc ba la ring mynshuwa ha ka point O.

Pynlasoh AO.

U AO u phiah ia ka $\angle BAK$ ar liang marbiang.

Jingpynshisha—(1) Thew ia ka jingheh ki $\angle KAO$ bad $\angle BAO$ da ka protractor bad khmih la ki ia ryngkat ne em.

(2) Khylliap ia ka $\angle KAB$ ha u line AO bad khmih la ka $\angle KAO$ ka ia ryngkat ne em bad ka $\angle BAO$.

(3) Jér kyrteng D ia ka point ha kaba u AO u ot ia ka arc PR. Thew ia ka jingjingai ki chord RD bad PD da u divider. Ki ia ryngkat? Lada kumta, kumno kane ka pynshisha ba ki $\angle KAO$ bad $\angle BAO$ ki ia ryngkat?

(4) Lada u radius ka arc ba la ring na ka centre P u kham jrong ban la u radius ka arc ba la ring na ka centre R, u line OA un dang long u line uba phiah ar liang marbiang la ka $\angle KAB$? Lada um long, sha kano ka kti (arm) jong ka $\angle KAB$ un kham thiah?

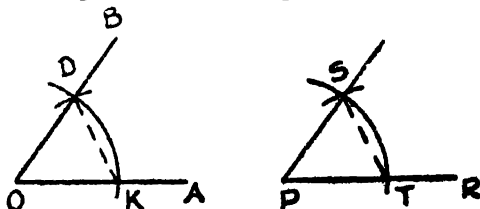
(5) Ha kaba ring la ki arc na u P bad R kum ki centre balei ngi shim la u radius uba palat la ka marshiteng jong u PR. Kan jia kumno lada shim u radius uba duna la ka marshiteng u PR?

LYNNONG XIII

BAN SHNA LA KI ANGLE

PROBLEM 3

Ban shna ka angle ka ban la ryngkat bad ka angle ba la ai.



Shna la ka $\angle AOB$. Shim kano kano jingheh. Kan kham bit ban shna da ka acute angle. Ai ba ki arm jong ka $\angle AOB$ kin jrong kumba ar inshi ne.

Jingsbna dur — Ring u line PR uba jrong kumba 2 inshi.

Na ka centre O bad da uno uno u radius ring kawei ka arc ka ban pom la u OA bad OB ha ka point K bad D.

Na ka centre P bad da ujuh u radius ring kawei ka arc ka ban pom la u PR ha ka point T.

Na ka centre T bad da u radius uba la ryngkat bad u chord KD ring kawei ka arc ka ban pom la ka arc ba la lah ring ha ka point S.

Pynlasoh PS.

Ka $\angle SPT = \angle AOB$.

Jingpynshisha—1. Thew ia ki angle baroh ar bad khmih la ki ia ryngkat ne em.

2. Buh dak ia ka $\angle AOB$ ha ka kot shini bad pyndait ia kata halor ka $\angle RPS$. Ki ia biang ne em?

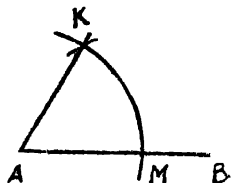
3. Lada ha kaba shna ia kitei ki angle ki circle ba la ring ki long da ki radius kiba ia pher phi tharai ka $\angle SPT$ kan ia ryngkat bad ka $\angle AOB$? Pyrshang ia kane da kaba ring ia ka circle na ka centre O da u radius uba kham jrong ban ia u radius ba ring ia ka circle na ka centre P . Yn jia aiu? Ki angle ha ka point O bad P kin ia ryngkat? Lada em, kano ka ban kham heh?

PROBLEM 4

Ban shna ka angle kaba 60° da u ruler bad compass

Ring u line AB .

Na ka centre A bad da uno uno u radius ring kawei ka arc ka ban pom ia u AB ha ka point M .



Na ka centre M bad da ujuh u radius ring kawei ka arc ka ban ot ia ka arc ba la ring mynshuwa ha ka point K .

Pyniasoh KA .

Ka $\angle KAB = 60^\circ$.

Thew ia kane ka angle da ka protractor bad khmih la ka long ne em 60° .

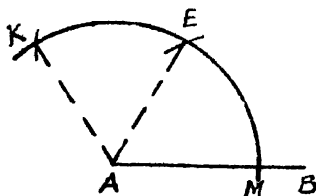
Phiah ia kane ka $\angle KAB$ ar liang marbiang. Katno ka jingheh kawei kawei na ki?

PROBLEM 5

Ban shna ka angle kaba 120° , da u ruler bad compass.

Ring u line AB.

Na ka centre A bad da uno uno u radius ring kawei ka arc ka ban pom ia u AB ha ka point M.



Na ka centre M bad da ujuh u radius ring arc ka ban pom ia ka arc ba la ring mynshuwa ha ka point E.

Na ka centre E bad da ujuh u radius ring arc ka ban pom pat ia ka arc ba la ring mynshuwa ha ka point K.

Pyniasoh KA.

Ka $\angle KAB = 120^\circ$.

Thew ia kane ka angle da ka protractor bad khmih la ka dei ne em 120° .

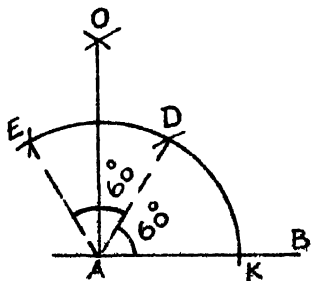
PROBLEM 6

Ban shna right angle, da u ruler bad compass.

Ka buit kaba nyngkong—

Ring u line AB.

Shna ka angle 60° ha ka point A. Shna sa kawei ka angle kaba 60° ha ka point A markhap bad ka angle ba la lah shna.



Phiah ia ka $\angle DAE$ ar liang marbiang da u AO.

Ka long kaba shai ba ka $\angle AOB = 90^\circ$.

Jingpynshisha—1. Thew ia ka $\angle OAB$ da ka protractor no set square bad khmih ka long katno degrees?

2. Katno ka jingheh ka $\angle DAK$, $\angle DAE$, $\angle DAO$ bad $\angle BAO$?

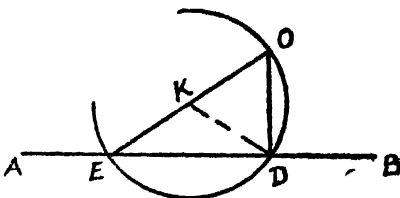
Phiah ar liang marbiang ia ka rt $\angle OAB$. Katno ka jingheh kawei kawei na ki? Nang phiah shuh sa ia kawei na ki. Katno ka jingheh kawei kawei na kita?

Ka buit kaba ar—

Ring u line AB.

Shim kano kano ka point K shabar u AB bad ka point D ha u AB.

Na ka centre K bad da u radius KD ring ka arc ka ban ot ia u AB ha ka point E.



Pyniasoh EK bad pynjrong ia u haduh ban da ia shem ia ka arc ba la ring ha u O.

Pyniasoh OD.

Ka $\angle ODA$ ka dei ka rt angle.

Thew ia ka bad khmih ka dei ne em.

Jingpyrshang 11

1. Da u ruler bad compass shna ia ka angle kaba 30° bad phiah ar liang marbiang ia ka. Thew ia ka jingtrei jong phi da ka protractor.

2. Shna da u ruler bad compass, ka angle kaba 45° bad $22\frac{1}{2}^\circ$.

3. Shna ka angle kaba 135° da ka protractor bad phiah lai liang marbiang ia ka. Shem ia ka jingheh kawei kawei ka angle da ka protractor.

4. Shna ka angle kaba 135° da u ruler bad compass.

5. Shna kawei ka right angle bad phiah lai liang marbiang ia ka da u ruler bad compass.

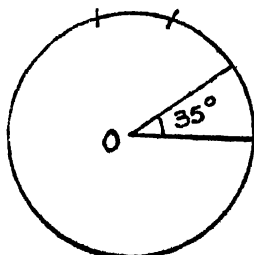
(Jingai jingmut — ka $\text{rt} \angle = 90^\circ$. Shna shuwa ka angle 60° na ka $\text{rt} \angle$ sa phiah ar liang marbiang ia ka.)

6. Shna ka angle kaba 75° da ka protractor. Da u ruler bad compass shna sa kawei ka angle ka ban ia ryngkat bad kata ka angle. thew ia kata ka angle ba phi shna da ka protractor.

7. Shna ka angle 120° da u ruler bad compass. Shna sa kawei pat ka ban ia ryngkat bad kane.

8. Shna ia ka angle kaba 35° da ka protractor. Da u ruler bad compass shna ka angle kaba lai shah ka jingheh ia kaba nyngkong. Thew ia ka jingheh kata ka angle da ka protractor.

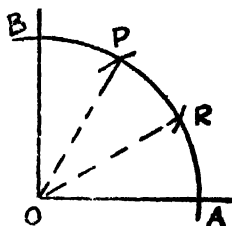
9. Nga kwah ban shna ka angle kaba saw shah ia ka angle ba la ai. Batai yn leh kumno ia kane.



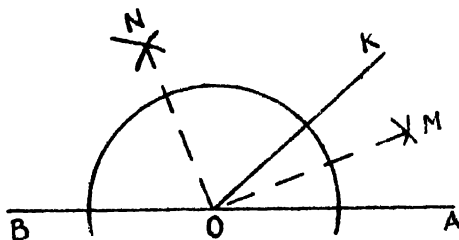
10. Ring kawei ka circle da uno uno u radius na ka centre O. Da ujuh u radius ot kawei ka arc AB na ka circumference kane ka circle. Pynlasoh OA bad OB Ka $\angle AOB$ ka long katno bynta na ka $4 \text{ rt} \angle$ s bad balei? Katno degree ka $\angle AOB$ ka don? Jubab shuwa bad sa da thew de.

11. Shna ka rt $\angle AOB$ da ka protractor. Na ka centre O bad da uno uno u radius ring ka arc AB . Kane ka arc ka long katno bynta na ka circumference jong kane ka circle?

Na ka centre A bad da ujuh u radius ot ia ka arc AB ha u P bad na ka centre B da ujuh u radius ot ia ka arc AB ha u R . Pynlasoh OP , OR .

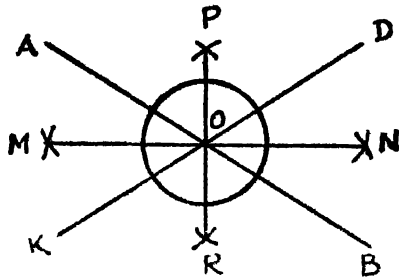


Katno ka jingheh ki $\angle AOR$, $\angle ROP$, $\angle POB$? Jubab da ai bad ki nia; sa thew.



12. Ring uwei u straight line AB . Shim kano kano ka poin O ha u bad ring ia u line OK uba da pynlong angle bad u AB . Phiah ar liang marbiang ia ki $\angle AOK$ bad $\angle KOB$ (da u ruler bad compass). Jér kyrteng ia ki line kiba phiah ia kine ki angle OM bad ON .

Thew ia ka jingheh ka $\angle MON$. Phi lah ban batai balei ka heh katta?



13. Ring ar tylli ki line AB , KD kiba ia pom ha ka point O . Phiah ia ki angle AOK bad BOD ar liang mar-biang (da u ruler bad compass) da ki line OM bad ON . Kine ki line (bisectors) ki ia long kumno?

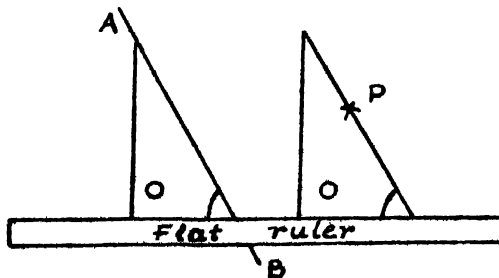
Phiah ruh ia ki $\angle AOD$ bad $\angle KOB$. Thew ia ka jing-heh ki angle ba la pynlong da kine ki line (bisectors) kiba phiah ia ki angle ha ka point O . Phi lah ban batai balei ki heh katta?

LYNNONG XIV

KI PARALLEL BAD PERPENDICULAR

PROBLEM 7

Lyngba ka point P ba la ai ring u line, da ka set square, u ban long parallel ia u line ba la ai.



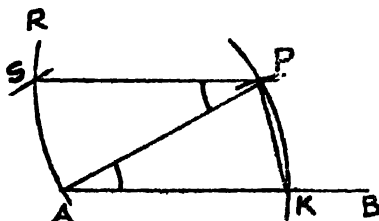
La ai u line AB bad ka point P bad la kwah ban ring u line na ka point P u ban long parallel ia u AB .

Jingshna dur--Buh ia ka set square ha kata ka' rukom ba kawei ka rymmiang set square ba jrong duh kan ia hab bad u **AB** kum ha katei ka dur. Pyndait ia u flat ruler na kawei pat ka liang ka set square. Bat skhem ia u, sa pynsyntuid ia ka set square haduh ba ka rymmiang set square kaba la pyndait ha u **AB** kan laid lyngba ka point **P**.

Ruid line na kane ka rymmiang. U line ba la ruid u long parallel ia u line **AB**. Thew ia ki corresponding angle ba la ruid dak ha ka dur. Ki dei ban ia ryngkat ne em?

PROBLEM 8

*Lyngba ka point **P** ba la ai ring u line, da u ruler bad compass, u ban long parallel ia u line **AB** ba la ai.*



La ai u line **AB** bad ka point **P**. La kwah ban ring line lyngba u **P** u ban long parallel ia u **AB**.

Jingshna dur--Na ka point **A** (ne na kano kano ka point ha u **AB**) kum ka centre bad da u radius **AP** ring ka arc ka ban ot ia u **AB** ha ka point **K**.

Na ka centre **P** bad da ujuh u radius ring kawei ka arc **AR**.

Na ka centre **A** bad da u radius uba jrong kat u chord **PK** ring ka arc ka ban pom ia ka arc **AR** ha ka point **S**.

Pynlasoh **PS**.

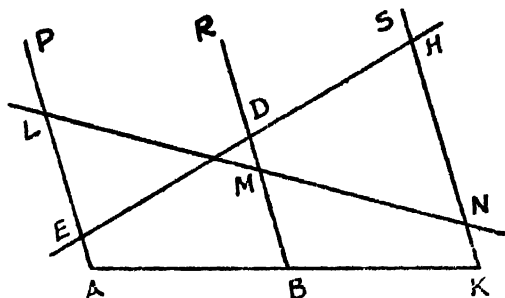
Tynjuh da ki set square ia u **PS** u long parallel ia u **AK**.

Jingpynshisha—Pyniasoh ia u AP. Thew bad khmih ia ki alternate angle PAK bad SPA ki ia ryngkat ne em. Lada ki ia ryngkat u AK bad u PS ki ia long parallel.

Kawei pat ka buit — Ia kane ka problem lah ban leh da kaba shna ki alternate angle kiba ia ryngkat ha ka point A bad P. (Ki khynnah kin pyrshang ban leh hi ia kane.)

Jingpyrshang 12

1. Shim ar tylli ki point A bad B kiba ia jngai 5 cm. Lyngba ka point A ring uwei u straight line; bad lyngba ka point B, ring, da ki set square, u line u ban long parallel ia u line ba phi ring lyngba ka point A.



2. Ring u line AK uba 2" ka jingjriong, bad ot ia u marshiteng. Lyngba ki point A, B bad K ring ki parallel AP, BR, KS sha kajuh ka phang (da ki set square). Ring uno uno u line u ban ot ia kine ki parallel ha u L, M bad N. Thew ia u LM bad MN. Phi shem kumno?

Ring sa uwei pat u line u ban ot ia ki parallel ha u E, D bad H bad thew ia u ED bad DH.

Ka jingringnia aiu phi ioh nangne? (*U nonghikai un talam jingmut ia kane.*)

3. Ring u line uba 4.5 cm ka jingjriong. Da ka protractor ring ia u AB u ban pynlong ia ka angle $66\frac{1}{2}^\circ$ bad u AB. Lyngba ka point B ring u line u ban pynlong parallel bad u AK (i) da ki set square (ii) da u ruler bad compass.

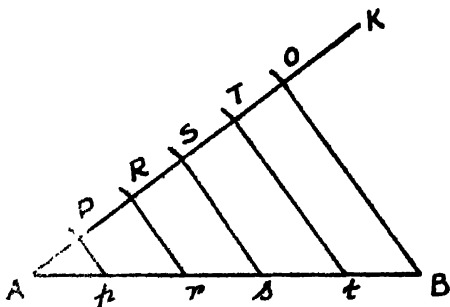
4. Leh biang ia ka Exercise 3 ha u line AB uba 5 cm uba da pynlong ka $\angle BAK$ kaba $23\frac{1}{4}^\circ$, da ki set square bad sa tynjuh ia ka jingshna dur jong phi da u ruler bad compass.

5. Shna ka right angle AOB da ka protractor ne set square. Shim ka jingjrong u OA bad OB = 6.5 cm. Lyngba ka point A ring u line u ban long parallel ia u OB bad lyngba ka point B ring u line u ban long parallel ia u OA. Leh ia kane da ki set square. Ka dur aiu phi ioh ynda phi la shna kumne?

6. Ring uno u straight line AB. Shem ia ka point P kaba katjuh ka jingjngai na u A bad u B katba u A u jngai na u B. Ring lyngba u P u line uba long parallel ia u AB.

PROBLEM 9

Ban bynta ia u line AB ba la ai ha ki san bynta kiba ia ryngkat.



Shim uno uno u line AB.

Jingshna dur — Ring u line AK uba da pynlong kano kano ka angle bad u AB.

Shim ia u compass bad pied ia u ba un ang kat ban ibit. Jám san jám da u compass ha u AK sdang na u A. Jér kyrteng ia kine ki jingjám AP, PR, RS, ST, TO.

Pynlasoh OB.

Lyngba ki point P, R, S bad T ring ki line ki ban long parallel bad u OB (da ki set square).

Kine ki parallel ki pynbynta ia u AB ha ki san bynta kiba ia ryngkat. Thew ia ki da u divider.

Ha kajuha rukom lah ban bynta ia uno uno u line ha ki lai, saw, hynriew ne ha katno katno bynta ba la kwah kiba ia ryngkat.

Jingpyrshang 13

1. Pyndonkam ia katei ka buit ban pynbynta ia u line AB uba 2 inshi ka jingjrong ha ki ar bynta kiba ia ryngkat; sa ot marshiteng ia u da ka buit ba la ai ha ka Problem 1. Khmih ki ia dei ne em?

2. Ring u line uba 4.4 cm. Pynbynta ia u ha ki saw bynta kiba ia ryngkat da ka buit ba la ai ha ka Problem 9.

Kumno phin leh ia kane da kaba pyndonkam tang da u ruler bad compass.

3. Na u line uba jrong 2.5", ot shi bynta na ka san bynta na une u line

4. $\frac{1}{2}$ jong ku $3\frac{1}{4}$ " long katno? Kheifi shuwa ia kane bad sa pynbynta ia u line uba $3\frac{1}{2}$ " ka jingjrong ha ki saw bynta. Thew ia ka jingjrong ka shi bynta bad sa ia nujor ka ia dei ne em bad kaba phi kheifi.

5. Shem ia ka $\frac{2}{3}$ jong ka $3\frac{3}{4}$ " da kaba shna dur.

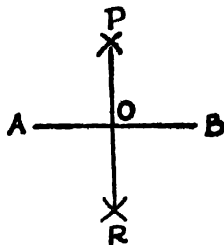
6. Na u line $3\frac{3}{4}$ " ka lynter, ot $\frac{2}{3}$ na u. Thew katno kaba sah.

7. Ring u line uba 3 shah ia ka ka 0.8" ka lynter. Sa shim $\frac{1}{2}$ na u. Shem ia ka lynter kaba sah. Pynshisha da kaba kheifi.

KI PERPENDICULAR

PROBLEM 10

Ban ring u straight line u ban ot marshiteng ia u AB uba da pynlong ki right angle, da u ruler bad compass.



Jingshna dur — Leh kum ha ka problem 1.

Na kane ka jingshna dur ngi fohi ba u **PR** u ot ia u **AB** marshiteng. Kaba donkam pat ka long ban pynhun ba u **PO** u pynlong ki right angle bad u **AB**, lane, u leng perpendicular ha u.

Jingpynshisha—1. Thew da ka protractor ia ki $\angle POA$ bad **POB**.

2. Ring ia kane ka dur ha ka kot shini bad khylliap ia ka kumta ba u **A** un hab ha u **B**. Khmih bha hangno ka dien khylliap ka hab bad batai balei ka hab hangta.

3. Ring ia kane ka dur ha ka kot shini kumba phi leh mynshuwa bad pynphai ia ka ha ka point **O** haduh ba ka dak ruid u **OA** kan hap ha u **OP**. Hangno ka dak ruid u **OP** ka hab? Pyni nangne ba u **PR** u pynlong ki right angle bad u **AB**.

Jingpyrshang 14

1. Ring uwei u line **AD** uba jrong 3·4 cm bad ot marshiteng ia u da u **PR** uba da pynlong ki right angle. Jied ia ki jong ki radius ha kaba ring ia ki arc.

Pyni da kaba thew ba u PR u ot marshiteng ia u AB bad u AB u ot marshiteng ia u PR. Khylliap ia ka dur ba phi shna ha u PR. Hangno ka point A kan hab? Khylliap ia ka dur ha u AB. Hangno ka point P kan hab? Ka dur ka long symmetrical ha u PR bad ruh ha u AB.

2. Shim ia u line AB uba jrong 4 inshi. Na ka centre A bad da u radius 3 inshi ring kawei ka circle. Na ka centre B bad da u radius 2 inshi ring sa kawei ka circle ka ban ot ia ka circle kaba nyngkong ha u P bad u R. Pynlasoh PR. Mynta u PR u ot ia u AB marshiteng u da pynlong artad ki right angle.

Kano ka bynta kaba dei na kane ka jingong, bad kano ka bym dei ?

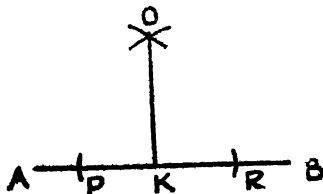
3. Ring uno uno u line AB. Ot marshiteng ia u da u PR uba da pynlong ki right angle bad u AB. Jied la ki jong ki radius; da thoh katno ka jingjrong jong ki.

Katno u P ne u R u jngai na u A bad u B?

4. Ring u line AB uba jrong 6 cm. Da u compass shem ar tylli ki point P bad R kiba ia jngai 5 cm na u A bad u B. Shem ruh ar tylli ki point L bad M kiba ia jngai 7 cm na u A bad u B, bad sa ar tylli ki point D bad E kiba ia jngai 8 cm na u A bad u B. Ha uno u line kine ki point baroh ki don? Katno tylli ki point kiba jngai 3 cm na u A bad u B ki don?

PROBLEM 11

Ha ka point K kaba ha u line AB ba la ai ring, da u ruler bad compass, u line u ban ieng perpendicular ha u.



La ai u line AB bad ka point K ha u na kaba yn ring u line u ban long perpendicular ha u AB.

Jingshna dur—Na ka centre **K** ot ar tylli ki bynta kiba ña ryngkat **KP** bad **KR** na u **AB**.

Na ka centre **P** bad **R** bad da u radius uba jrong palat ña u **PK** ring ar tylli ki arc ki ban ña pom ha ka point **O**.

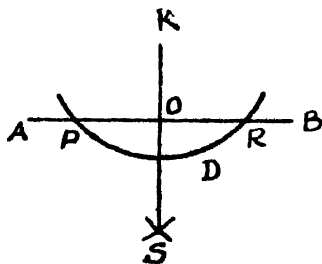
Pynlasoh **OK**.

Jingpynshisha—1. Tynjuh da ka protractor la u **OK** u long perpendicular ha u **AB**.

2. Tynjuh da ki set square ruh.

PROBLEM 12

*Ring, da u ruler bad compass, u line u ban ñeng perpendicular ha u line **AB** ba la ai na ka point **K** kaba shabar jong u.*



La ai u line **AB** bad ka point **K** shabar jong u na kaba yn ring u perpendicular ha u **AB**.

Shim ka point **D** ha ka liang u **AB** kaba jngai na u **K**.

Jingshna dur — Na ka centre **K** bad da u radius **KD** ring arc ka ban ot la u **AB** ha ka point **P** bad **R**.

Na ka centre P bad R bad da u radius uba jrong palat ia ka shiteng u PR ring ar tylli ki arc ki ban ia pom ha ka point S kaba sha ka liang u AB ka bym don u K.

Pyniasoh KS u da ot ia u AB ha u O.

U KO u leng perpendicular ha AB.

Jingpyshisha— 1. Tynjuh da ka protractor.

2. Tynjuh da ki set square.

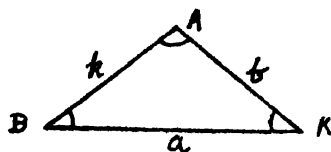
Jingpyrshang 15

1. Da ki set square ne protractor shna ka right angle AOB; pynlong ia u $AO = 3$ inshi $OB = 4$ inshi. Pyniasoh AB Na u O ring u perpendicular ha u AB da u ruler bad compass.

2 Ring uno uno u line AB. Shem da ka compass ia ka point P kaba jngai 5.5 cm na ki tdueh jong u. Na ka point P ring perpendicular PR ha u AB, da u ruler bad compass. Thew ia u PR.

LYNNONG XV

BAN SHNA KI TRIANGLE



Ngi la nang ban shna ia ki triangle. Ki jingshisha ba ngi dei ban kymaw shaphang ki triangle ki long:—

(a) Ka triangle ka don hynriew bynta, lai tylli ki side bad lai tylli ki angle.

Ha ka $\triangle ABK$ ia ki side BK, KA, AB ki khot ruh a, b, k ter ter. Ia ki $\angle BAK$, $\angle ABK$, $\angle AKB$ ki khot $\angle A$, $\angle B$, $\angle K$ ter ter.

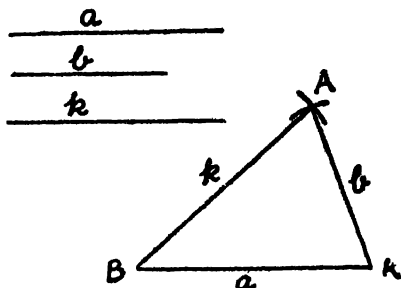
(b) Kino kino ar tylli ki side jong ka triangle baroh lang ki kham jrong ia uba lai.

(k) Ka sum ki lai tylli ki angle ka triangle ka long 2 right angles ne 180°

To ngin ia shna sa katto katne tylli ki triangle haba la ai kino kino lai tylli ki bynta jong ka.

PROBLEM 13

Ban shna ka dur lai dong haba la ai ia ka lynter ki side jong ka.



La ai ba a, b, k ki long ki side ka triangle kaba yn shna.

Jingshnadur—Ring u line BK uba ia ryngkat bad u a . Na ka centre B da u radius k ring kawei ka arc.

Na ka centre K da u radius b ring sa kawei ka arc ka ban pom ia ka arc ba la ring mynshuwa ha ka point A.

Pynfasoh AB bad AK.

Ka $\triangle ABK$ ka long ka triangle kaba ki side jong ka ki ia ryngkat bad kiba la ai.

Katno tylli kiba kum kine ki triangle lah ban shna?

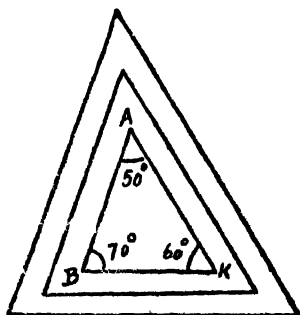
Jingpyrshang 16

1. Shna ki triangle kiba ia ki side jong ki la ai harum, bad thew ia ka jingheh ki angle ha kawei-pa-kawei ka triangle.

(i) $a = 2.0''$	$b = 2.0''$	$k = 2.0''$
(ii) $a = 3.0''$	$b = 1.5''$	$k = 1.5''$
(iii) $a = 3.0''$	$b = 2.5''$	$k = 1.8''$
(iv) $a = 5.4 \text{ cm}$	$b = 7.6 \text{ cm}$	$k = 3.5 \text{ cm}$
(v) $a = 4.5 \text{ cm}$	$b = 7.0 \text{ cm}$	$k = 4.5 \text{ cm}$
(vi) $a = 6.2 \text{ cm}$	$b = 6.2 \text{ cm}$	$k = 6.2 \text{ cm}$

PROBLEM 14

Ban shna ia ka triangle haba la ai ia ka jingheh ki lai tylli ki angle jong ka



La ai, ka $\angle A = 50^\circ$, $\angle B = 70^\circ$, $\angle K = 60^\circ$ ban shna triangle.

Ring uno uno u line BK kum ka base.

Pynlong ha u B bad u BK ka $\angle B = 70^\circ$ bad ha u K bad KB ka $\angle K = 60^\circ$. Ka $\angle A$ ka dei ban long 50° .

Thew ia ka.

Lada shim da kawei ka base kaba da kawei pat ka jingjrong bad shna ki angle B bad K kumba la leh, ka $\angle A$ ka dei hi ban long 50° .

Lada shna kumne bunsien ha ki base kiba ia pher ka jingrong, ngln loh bun ki triangle kiba ka jingheh ki angle ki long kumba la ai.

Nangne ngi lohi ba lah ban shna ia ka dur ka triangle haba la ai ia ki lai tylli ki angle jong ka ; hynrei ym lah ban pynthikna ia ka jingheh jong ka. Ka jingheh ka triangle ka shong ha ka jingrong ka base ba la shim.

Da ki lai tylli ki angle ba la ai, lah ban shna ia ka dur ka triangle ; hynrei ym lah ban buh thikna ia ka jingheh jong ka.

Jingpyrshang 17

1. Shna triangle kaba ka $\angle A = 65^\circ$, $\angle K = 25^\circ$ bad $\angle B = 91^\circ$.

2. Ha ka $\triangle ABK$, $\angle A = 28^\circ$, $\angle K = 112^\circ$, katno ka $\angle A$?

3. Katno tylli ki triangle lah ban shna haba ka $\angle A = 90^\circ$, $\angle B = 48^\circ$, $\angle K = 41^\circ$.

4. Pyrshang ia kane. Shim uno uno u line BK kum ka base ka triangle ba yn pyrshang shna. Ha ka point B bad ha u BK, shna ka angle kaba 135° bad ha ka point K bad ha u KB shna ka angle kaba 45° . Khmih, lah ne em ban shna triangle da kine ki jingthew? Lada em, balei?

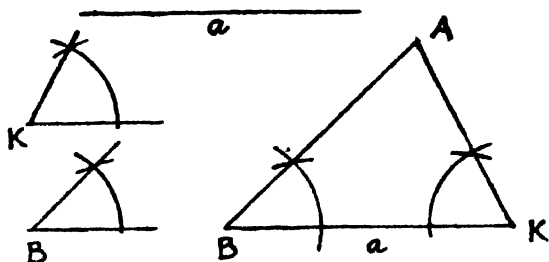
(Pyndonkam da ka protractor ban shna ia kitei ki angle.)

5. Lada shna pat ka triangle ha ka base BK bad da pynlong ki angle ha ka base kiba 120° bad 80° ; jia aiu?

(N.B.—Ka sum ki ar tylli ki angle ba la ai jong ka triangle ba la kwah ban shna ka dei ban duna ia ka 2 rt. \angle s.)

PROBLEM 15

Ban shnu ka triangle haba la ai uwei u side bad ki angle ha ki tduh jong u.



La ai u side a bad ki $\angle B$ bad $\angle K$ da kiba yn shna ia ka $\angle ABK$.

Jingshna dur — Ring u line BK uba ia ryngkat bad u a .
Ha ki tduh jong u BK shna ki $\angle KBA$ bad $\angle BKA$ kiba ia ryngkat bad ki $\angle B$ bad $\angle K$ ter ter da u ruler bad compass.

Pynjrong ia ki kti kine ki angle kat haduh ba kin ia shem ha u A .

Ka $\triangle ABK$ ka long ka triangle ba la shna da ki jingthaw ba la ai.

Jingpyrshang 18

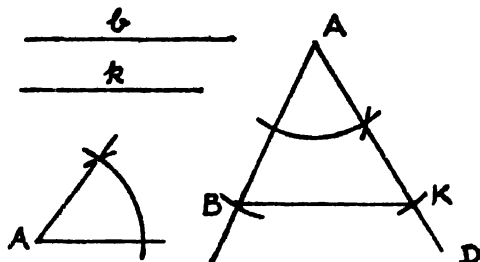
1. Shna ka $\triangle ABK$ kaba u side $a = 3.2''$, $\angle B = 72^\circ$ bad $\angle K = 37^\circ$. Thew katno ka jingheh ka $\angle A$

2. Kawei-pa-kawei na ki angle ha ka base jong ka triangle ka long 75° ; katno ka jingheh ka vertical angle?

3. Shna triangle kaba u $a = 34''$, $\angle B = \angle K = 66\frac{1}{2}^\circ$. Thew ia u b bad u k bad ong ka jait triangle aiu phi loh.

PROBLEM 16

Ban shna ka triangle haba la ai ar tylli ki side bad ka angle kaba la pynlong da ki



La ai ia u side b bad k bad ka $\angle A$ da kiba yn shna ia ka triangle.

Jingshna dur — Ring uno uno u line $AB = k$; lia u A shna ka $\angle BAD$ kaba ia ryngkat bad ka $\angle A$.

Na u AD ot $AK = b$.

Pyniasoh BK.

Ka $\triangle ABK$ ka long ka triangle ba la shna kat kum ki jingthew ba la ai.

Jingpyrshang 19

1. Shna ka triangle ABK haba la ai u side $b = 1.8''$, $k = 2.7''$ bad ka $\angle A = 65^\circ$.

2. Shna ka right angle BAK da u ruler bad compass, da pynlong ia u $AB = AK = 3.5''$. Pyniasoh BK.

Thew ia ki angle B bad K. Katno degree kawei kawei ka don? Kine ki angle ki ia long kumno, bad balei?

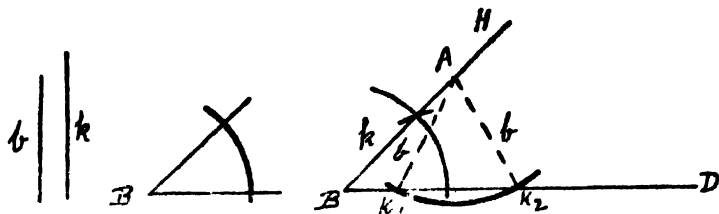
3. Shna ka $\triangle ABK$ kaba u $AB = AK = 6.5$ cm bad ka $\angle A = 84^\circ$. Phi lah ban ong khlem thew katno degree ka jingheh ka $\angle B$ bad $\angle K$? Ka jait triangle aiu phi ioh?

4. Shna ka triangle kaba ki angle ha ka base ki long kawei kawei 60° bad u $a = 3.5$ cm.

Katno ka jingheh ka $\angle A$ bad ka jait triangle aiu phi oh?

PROBLEM 17

Ban shna ka triangle haba la ai ar tylli ki side bad ka angle kaba ia pyrshah ia kawei na ki.



La ai ki side b bad k bad ka $\angle B$.

Jingshna dur — Ring uno uno u line BD bad ha u B thaw ka $\angle DBH = \angle B$.

Na u BH ot $BA = k$.

Na ka point A kum ka centre bad da u radius b ring kawei ka arc.

Lada kane ka arc ka ot ia u BD ha ki ar tylli ki point k_1 bad k_2 sha kajuha liang u B ngi ioh ar tylli ki $\triangle ABK_1$ bad ABK_2 kiba kat kum ka jingthew ba la ai.

Katno tylli ki triangle yn ioh haba—

(a) u b u kham jrong ia u k .

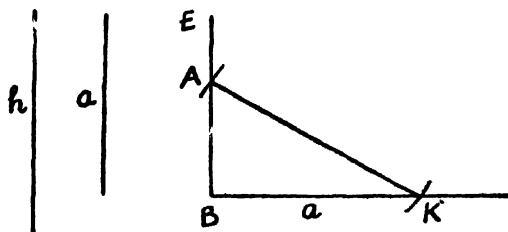
(b) u b u ia ryngkat bad u k .

(k) u b u ia ryngkat bad u perpendicular na u A ha u BD .

(d) u b u kham lyngkot ban ia une u perpendicular.

PROBLEM 18

Ban shna ka right-angled triangle haba la ai u hypotenuse bad uwei u side.



La ai h u hypotenuse bad a uwei u side ban shna ia ka right-angled triangle.

Jingshna dur - - Ring u line BK u ban ia ryngkat bad u a
Ha ka point B ring u perpendicular EB ha u BK .

Na ka centre K bad u radius h ring arc ka ban ot ia u BE ha ka point A .

Pynfasoh KA .

Ka $\triangle ABK$ ka long ka right-angled triangle kat kuno ki jingthew ba la ai.

LYNNONG XVI

KI TRIANGLE (*shuh shuh*)

Ka jingiaryngkat ki ar tylli ki triangle nadong shadong

(*Congruence of triangles*)

Ngi tip ba ka triangle ka don lai tylli ki side bad lai tylli ki angle. Ia kine ki khot ki hynricw bynta jong ka triangle. Ar tylli ki triangle la ong ba ki ia ryngkat nadong shadong haba syrtap ia kawei ka triangle ha'or kawei pat ki ia dai sbiak. Haba long kumne, kawei-pa-kawei ka bynta jong ka triangle kaba nyngkong ka ia ryngkat bad ka bynta ba ia dei (corresponding part) ha ka triangle kaba ar, ki side para side bad ki angle para angle bad ki triangle ruh ki ia ryngkat ha ka jingheh.

Ha kiba kum kine ki triangle ki side ba ia dei (corresponding sides) ki long kiba ia pyrshah ia ki angle ba ia ryngkat, bad ki angle ba ia dei (corresponding angles) ki long kiba ia pyrshah ia ki side ba ia ryngkat.

Kum ka jingpyni nuksa - Shim ar tylli ki set square kiba 45° . Syrtap ia ki kawei halor kawei ba kin ia dait bhi sbiak. Da kaba leh kumne ngi iohi ba ki dong matang ki ia-bi para dong matang; ki dong 45° para dong 45° .

Nangta pat,—ki side ba ia pyrshah ia ki dong matang ki ia-bi para ki bad ki side ba ia pyrshah ia ki dong 45° ruh ki ia-bi para ki.

Pyrshah leh kumjuh ia ki ar tylli ki set square kiba 60° , 30° . Phi shem aiu? Kior ki corresponding part kiba ia ryngkat ha kine ki ar tylli ki set square, kiba long ruh ki triangle?

1. Ring ar tylli ki $\triangle ABK$, DEH kiba u $BA = ED$
 $BK = EH$ bad ka $B = \angle E$.

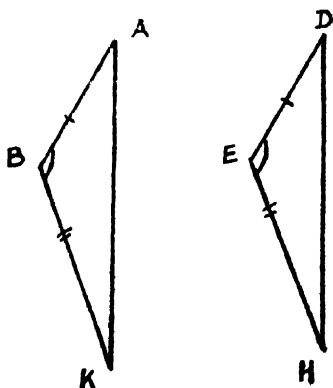
Ot ia ka $\triangle BAK$ bad syrtap ia ka halor ka $\triangle EDH$. kumta ba ka point B kan hab ha ka point E bad u BA halor u ED .

Hangno u BK u hab bad balei?

Hangno u A bad u K ki hab bad balei?

Hangno AK u hab?

Nangne ngi iohi ba ka $\triangle BAK$ ka ia dait sbiak bad ka $\triangle EDH$, Ki 6 bynta ka $\triangle BAK$ ki ia ryngkat bad ki 6 bynta ka $\triangle EDH$, kumne: -



(1) $BA = ED$

(4) $\angle B = \angle E$

(2) $BK = EH$

(5) $\angle A = \angle D$

(3) $AK = DH$

(6) $\angle K = \angle H$

Ki triangle ruh ki ia ryngkat ha ka jingheh (area).

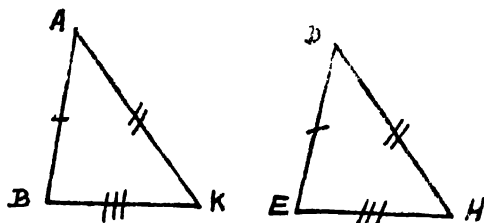
Kumta ngi loh ia kane ka jingong—

Lada ar tylli ki side jong kawei ka triangle ki ia ryngkat bad ar tylli ki side jong kawei pat, uwei-ia uwei, bad ki angle ba la pynlong da ki ruh ki ia ryngkat. kita ki triangle ki ia ryngkat nadong shadong.

Jubab:—(i) Lah ban ong ba ka $\angle A = \angle E$; $\angle B = \angle H$ bad $\angle K = \angle D$; balei?

(ii) Lah ban ong ba u $AB = DH$; $BK = DE$ bad $AK = EH$, balei?

2. Ring ar tylli ki $\triangle ABK$, $\triangle DEH$ kiba u $AB = DE$ u $AK = DH$ bad u $BK = EH$.



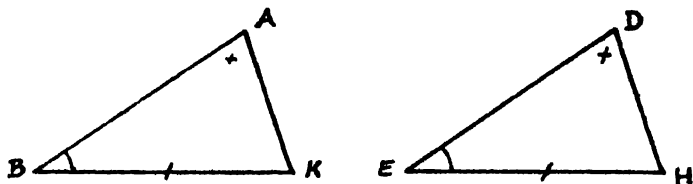
Ot ia kine ki triangle bad khmih kumno yn syrtap ia ki ba kin ia dait sbiak.

Lada da ka jingpyrshang, phi shem ba ki ia dait sbiak ong kino ki corresponding part jong kine ki triangle kiba ia ryngkat.

Nangne pat ngi loh ia kane ka jingong--

Haba lai tylli ki side jong kawei ka triangle ki ia ryngkat bad lai tylli ki side jong kawei pat, uwei-ia-uwei, kita ki ar tylli ki triangle ki ia ryngkat nadong shadong.

3. Ring ar tylli ki $\triangle ABK$, $\triangle DEH$ kiba u $BK = EH$, ka $\angle B = \angle E$ bad ka $\angle A = \angle D$



Hangne ruh, ot ia kine ki triangle bad khmih kumno yn syrtap ia ki ba kin ia dait sbiak.

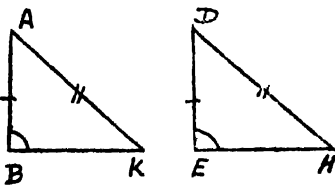
Ong ia ki corresponding part jong kine ki triangle kiba ia ryngkat.

Nangne ngi ioh ia kane ka jingong—

Haba ar tylli ki angle jong kawei ka triangle ki ia ryngkat bad ki ar tylli ki angle jong kawei pat, kawei-ia-kawei, bad uno uno u side jong kaba nyngkong u ia ryngkat bad u side ba ia dei (corresponding side) jong kaba ar, ki triangle ki ia ryngkat nadong shadong.

4. Ring ar tylli ki right angled $\triangle ABK$, $\triangle DEH$ kiba u $AB = DE$, u $AK = DH$ bad ki $\angle B$ bad $\angle E$ ki dei ki right angle.

Pyrshang da kaba ot bad syrtap ia kine ki triangle ban shem ba ki ia ryngkat nadong shadong. Thoh ruh ia ki corresponding part kine ki triangle.



Nangne ruh ngi ioh ia kane ka jingong—

Lada ki hypotenuse jong ki right-angled triangle ki ia ryngkat, uwei u side jong kawei ka triangle ruh u ia ryngkat bad uwei pat u side jong kawei pat, ki triangle ki ia ryngkat nadong shadong.

Jingpyrshang 20

1. Ha ka $\triangle ABK$, kaba u $AB = u$ AK bad u AD u leng perpendicular ha u BK . Kumno lah ban ong ba ki $\triangle ABK$, AKD ki ia ryngkat nadong shadong.

2. Ha ka isoscoles $\triangle XYZ$ kaba u $XY = u$ XZ bad ia u X la pyniasoh sha ka point O kaba long ka pdeng u YZ . Pyni ba ki $\triangle XYO$, XZO ki ia ryngkat nadong shadong.

3. Ha ka dur sawdong $ABKD$ kaba baroh ki side ki ia ryngkat uwei-ia-uwei pat, pyni ba ki triangle ba la pynlong da kaba pyniasoh ia u A bad u K ki ia ryngkat nadong shadong.

4. Ha ka triangle ABK , u AD u phiah ia ka angle BAK marbiang bad u leng perpendicular ha ka base BK . Pyni ba ki $\triangle ABD$ bad AKD ki ia ryngkat nadong shadong.

LYNNONG XVII

KI QUADRILATERAL

Shna kawei ka $\triangle ABK$. Nangta pat ha u AK shna sa kawei ka $\triangle ADK$. Ngi loh ia ka dur $ABKD$ kaba la ker kut da ki side AB , BK , KD , DA . Ka dur $ABKD$ ka dei ka quadrilateral

Kano kano ka dur kaba ker kut da ki saw side la khot quadrilateral.

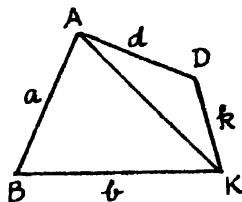
Ia ki point A, B, K, D ki khot ki vertex ka quadrilateral. Ia ki angle pat la khot $\angle A$, $\angle B$, $\angle K$, $\angle D$.

Ia ki side jong ka la ju ong kumne ruh :- a ia u AB , b ia u BK , k ia u KD bad d ia u DA .

Ia u line AK ki khot diagonal. U diagonal u long u line ba la pyniasoh ia ki vertex kiba ia pyrshah ha ka quadrilateral.

Katno tylli ki diagonal ki don ha ka quadrilateral?

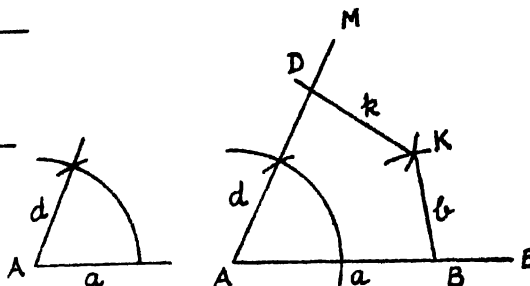
Ka sum jong ki angle ha ka $\triangle ABK = 2\text{rt } \angle s$ bad ka sum jong ki angle ha ka $\triangle ADK$ ruh $= 2\text{rt } \angle s$. Namar-kata, ka sum jong ki angle ha ka quadrilateral kan long katno?



PROBLEM 19

Shna ka quadrilateral haba la ai ka jingjrong ki side jong ka bad ka angle ba la pynlong da ka shi jur ki side ba marjan.

a _____
 b _____
 k _____
 d _____



La ai ki side a, b, k, d bad ka $\angle A$ ba la pynlong da ki side a bad d.

Jingshnador — Shim uno uno u line AE.

Pynlong ka $\angle EAM$ ha u A ka ban ia ryngkat bad ka $\angle A$ ba la ai, da u ruler bad compass.

Na u AE ot $AB = a$ bad na u AM ot $AD = d$.

Na ka centre B bad u radius b ring kawei ka arc.

Na ka centre D bad u radius k ring kawei ka arc ka ban pom ia ka arc ba la ring ha ka point K.

Pyniasoh DK bad BK.

Ka dur ABKD ka long ka quadrilateral ba la kwah ban shna kat kum ki jingthaw ba la ai.

Jingpyrshang 21

1. Shna quadrilateral da kine ki jingthaw:—

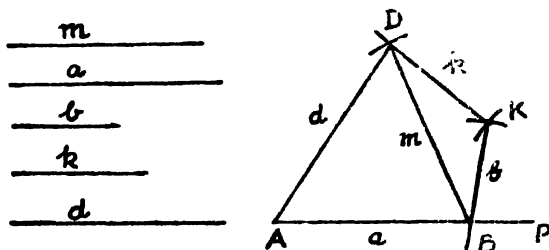
(i) $a = 2.4''$, $b = 1.4''$, $k = 1.3''$, $d = 2.1''$, ka angle ba la pynlong da u a bad $d = 50^\circ$.

(ii) $a = 3.2''$, $b = 2.0''$, $k = 1.9''$, $d = 2.5''$, ka angle ba la pynlong da u a bad u $d = 75^\circ$.

- (iii) $a = 4.5$ cm, $b = 3.9$ cm, $k = 4.0$ cm, $d = 5.0$ cm
ka $\angle A = 90^\circ$.
- (iv) $a = 3.5$ cm, $b = 4.4$ cm, $k = 3.2$ cm, $d = 2.7$ cm
ka $\angle A = 120^\circ$.

PROBLEM 20

Shna ka quadrilateral haba la ai ka lynter ki side bad u diagonal.



La ai ki side a, b, k, d bad u diagonal m ban shna ia ka quadrilateral.

Jingshnadur — Shim uno uno u line AP .

Na u AP ot $AB = a$.

Na ka centre B bad da u radius m ring kawei ka arc.

Na ka centre A bad da u radius d ring kawei ka arc ka ban ia pom bad ka arc ba la ring ha u D .

Pyniasoh AD bad BD .

Na ka centre B bad u radius k ring kawei ka arc ka ban ia pom bad ka arc ba la ring ha u K .

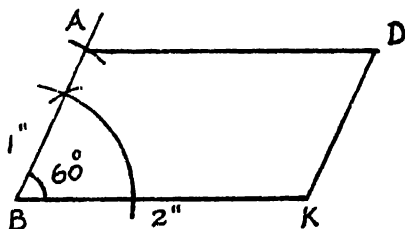
Pyniasoh BK bad DK .

Ka dur $ABKD$ ka long ka quadrilateral ba la kwah ban shna.

Jingpyrshang 22

1. Shna quadrilateral da kine ki jingthew—

- (i) $a = 2.0''$, $b = 1.2''$, $k = 1.5''$, $d = 1.8''$ bad $m = 1.8''$.
 (ii) $a = 2.8''$, $b = 1.2''$, $k = 1.3''$, $d = 2.0''$ bad $m = 2.1''$
 (iii) $a = 3.0$ cm, $b = 2.2$ cm, $k = 2.4$ cm, $d = 4.0$ cm bad $m = 4.0$ cm.
 (iv) $a = 3.8$ cm, $b = 2.4$ cm, $k = 1.9$ cm, $d = 4.5$ cm bad $m = 3.6$ cm.



Shna ka $\angle ABK$ kaba 60° kaba ki kti jong ka kin long $2''$ la $1''$.

Lyngba ka point A bad K ring ki line ki ban long parallel ia u BK bad BA (da ki set square) bad ba kin ia kynduh la ka point D.

Ka dur ABKD ka long ka quadrilateral kaba ki side kiba ia pyrshah ki long parallel. Ia kiba kum kine ki quadrilateral ki khot **parallelogram**.

Ka **parallelogram** ka long ka quadrilateral kaba ki side kiba ia pyrshah ki ia long parallel.

Thew ia u AD bad BK, AB bad DK. Phi shem aiu nangne? Thew ia ka jingheh ki $\angle ADK$, $\angle DKB$ bad $\angle BAD$ Phi shem aiu nangne?

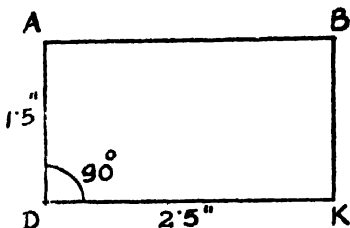
Jingpyrshang 23

1. Shna ka parallelogram **ABKD** kaba ka; $\angle B = 45^\circ$, $BA = 5.2$ cm bad $BK = 3.4$ cm.

Thew bad ia nujor (i) ia ki side kiba ia pyrshah (ii) ki angle ba ia pyrshah; thoh ia kiba phi loh nangta. Kynmaw ia ki jingshisha ba phi loh nangne.

2. Shna ka parallelogram **ABKD**, kaba ka $\angle D = 90^\circ$, $AD = 1.5''$ bad $DK = 2.5''$.

Thew ia ki side ba ia pyrshah bad ia ka jingheh kiwei pat ki angle ha kane ka dur.

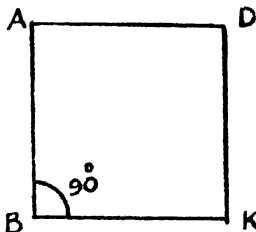


Phi lohi ba kane ka parallelogram ka don kawei na ki angle jong ka kaba long ka right angle. Ia kiba kum kita ki parallelogram ki khot rectangle.

Ka rectangle ka long ka parallelogram kaba kawei na ki angle jong ka ka long ka right angle.

3. Shna kawei ka rectangle ka ba u side $AB = BK = 3.5$ cm

Shna ka $\angle ABK = 90^\circ$. Ot ia ki kti kane ka angle 3.5 cm uwei uwei.

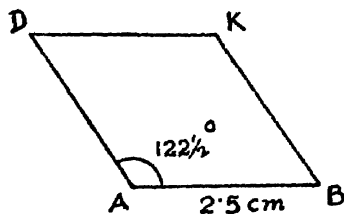


Ring ki parallel AD bad KD na ki point A bad K ki ban ia long parallel ia u BK bad AB ter ter.

Thew ia u AD bad KD bad ia nujor bad ki side ba ia ai. Nangne ngi loh ia ka rectangle **ABKD** kaba ki side kiba pynlong ia ka right angle ki ia ryngkat. Ia kiba kum kine ki rectangle ki khot square.

Ka square ka long ka rectangle kaba ki side ba pynlong ia ka right angle ki ia ryngkat.

4. Shna ka parallelogram $ABKD$, kaba ka $\angle A = 122\frac{1}{2}^\circ$,
 $AB = AD = 2.5$ cm.



Shna ka $\angle BAD = 122\frac{1}{2}^\circ$, ot ia u AB bad AD mar
 2.5 cm.

Ring lyngba ki point B bad D ki parallel BK , DK ki
 ban ia long parallel ia u AD bad AB bad ai kin ia shem ha
 ka point K .

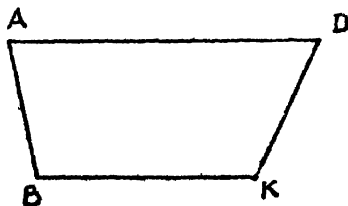
Thew ia u BK bad DK . Ki side jong kane ka dur ki
 ia long kumao? Thew ia ka jingheh ki angle ADK , ABK
 bad BKD .

Ka dur $ABKD$ ka dei ka parallelogram kaba ki side
 jong ka baroh ki ia ryngkat hynrei ki angle kim long right
 angle. Ia kiba kum kine ki parallelogram ki khot rhombus.

Ka rhombus ka long ka parallelogram kaba baroh ki
 side jong ka ki ia ryngkat hynrei ki angle kim long ki right
 angle.

5. Ring ar tylli ki line AD bad BK kiba ia parallel bad
 ia pher ka lynter. Pyniasoh AB , DK .

Ngi ioh ka quadrila-
 teral $ABKD$ kaba ar tylli
 ki side jong ka ki ia long
 parallel. Ia kiba kum kine
 ki quadrilatetal ki khot
 trapezium.



Ka trapezium ka long ka quadrilateral kaba ar tylli ki
 side jong ka ki long parallel.

Kynmaw — ka rectangle, ka square bad ka rhombus ki dei ki dur ba kyrpang jong ki parallelogram.

6. To ngin lum lang ia ki jingshisha ba ngi ioh na kitei ki jingringdur.

(i) Aiu ngi ring nia ia ki side bad ia ki angle ba ia pyrshah ha ka parallelogram?

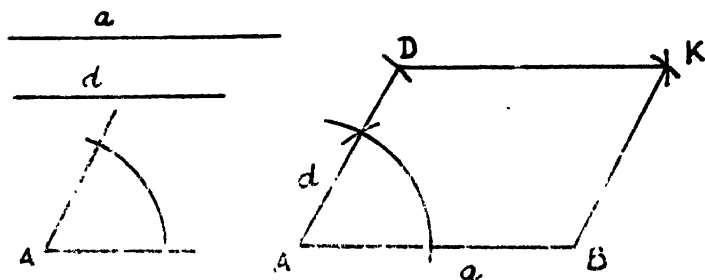
(ii) Lada kawei na ki angle ka parallelogram ka long right angle; katno ka jingheh kiwei pat?

(iii) Kiei ki jingshisna ba phi ring ia ki angle jong ka rectangle bad ka square?

(iv) Ki side ka square, rhombus bad trapezium ki ia long kumno?

PROBLEM 21

Ban shna ka parallelorgam haba ia ai ia ki side ba marjan (adjacent sides) bad ka angle ba la pynlong da ki, da u ruler bad compass.



La ai u a bad d bad ka $\angle A$ ban shna ia ka parallelogram.

Jingshna dur — Ring ia u AB uba ka jingjriong kat u a.

Pynlong ka $\angle BAD$ ka ban ia ryngkat bad ka $\angle A$ ba la ai. Ot ia u AD kat u b.

Na ki centre B bad D bad da ki radius d bad a ring aro ki ban ia pom ha u K. Pynlasoh DK bad BK.

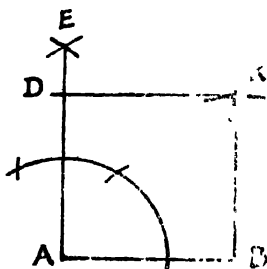
Ka dur ABKD ka long ka parallelogram ba la kwah ban shna.

Jingpynshisha—Thew da ki set square la ki side kiba fa pyrshah ki fa long parallel ne em?

Na ka jingshna dur u side $AB = a$; $AD = d$ bad ka $\angle BAD = \angle A$.

PROBLEM 22

Ban shna ka square ha u side ba la ai, da u ruler bad compass.



La ai u side AB ha uba yn shna fa ka square.

Jingshna dur — Ha ka point A shna da u ruler bad compass ka rt $\angle BAD$ da pynlong fa ka jingjrung u AD kat u AB .

Na ka centre B bad D bad da u radius AB ring arc ki ban fa pom ha u K .

Pynfasoh DK bad BK .

Ka dur $ABKD$ ka long ka square ba la kwah ban shna.

Jingpynshisha — Thew da ki set square la ki side ba fa pyrshah ki fa long parallel ne em?

Da ka jingshna dur ki side baroh ki fa ryngkat bad u AB . Ka $\angle BAD$ ruh ka dei ka right angle.

Jingpyrshang 24

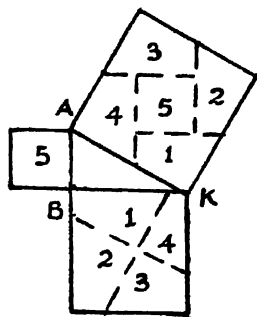
1. Shna square ha u side uba 2.5 inshi. Pynfasoh fa ki diagonal jong ka. Phi shem jingshisha aiu kaba fa dei ad ki diagonal?

2. Shna ña ka square **ABKD**. Pynñasoh ña ki diagonal ki da ña pom ha ka point **O**. Thew ña u **OA**, **OB**, **OK**, **OD**. Phi shem aiu?

3. Shna square ha u diagonal uba 3·0 inshi.

Jingai jingmut -- Nyngkong shim u line **AK** uba 3·0". Ot ña u marshiteng ha ka point **O**. Ring u line **BD** na ka point **O** uba da pynlong artat ki right angle bad u **AK**. Pyndep ña kaba sah.

4. Shna kawei ka right-angled triangle **ABK**. Shna square ha ki side jong ka. Lyngba ka middle point jong ka square ha u **BK** (kata, ka point ha kaba ki diagonal kane ka square ki ña pom) ring line kaba ña parallel bad ñeng perpendicular bad u hypotenuse **AK**.



Ot ña ka square ha u **BK** ha ki line ba la buh da ki dot bad ruh ña ka square ha u **AB**.

Pyrshang pyndait ña kine ki dur ha ka square ha u **AK**. Ngi shem aiu na kane ka jingpyrshang?

Ka square ha u **AB** + ka square ha u **BK** = ka square ha u **AK** lane, ngin thoh kumne $AB^2 + BK^2 = AK^2$.

Ngi ong ruh, ha ka right-angled triangle ka square ha u hypotenuse ka ña ryingkat bad ka sum jong ki square ha ki side ba pynlong ña ka right angle.

5. Shna kawei ka right-angled triangle kaba ki side kiba pynlong ña ka right angle kin long 3" bad 4". Ynda phi thew phin shem ba u hypotenuse u jrong 5".

Shna square ha uwei-pa-uwei u side jong kane ka right-angled \triangle .

Ia ki adjacent side jong ka square ba phi shna ha u side uba 3", bynta ia ki uwei uwei ha ki 3 bynta kiba marbiang marbiang. Lyngba kine ki point ba la bynta ia kine ki side, ring ki line ki ban ia long parallel bad ki line pynlong bad ki line pyngkiang kane ka square. Phin shem ba ia kane ka square la bynta ha ki square kiba shi square inshi ka jingheh bad ki don baroh 9 ting kiba kum kita.

Leh kumjuh ia ka square kaba phi shna ha u side uba 4" bad 5".

Nangne ngi lohi ba—

Ka square ha u hypotenuse ka ia ryngkat bad ka sum jong ki square ha ki side ba pynlong ia ka right angle.

LYNNONG XVIII

BAN SHNA DUR KAT KUM KA SCALE

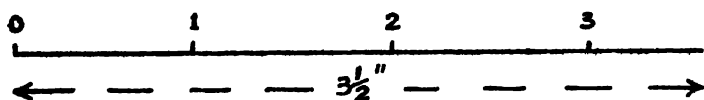
Ngin donkam ka kot kaba heh bha ban ring dur ia ka blackboard, ka jingkheng, ka ting skul, ka shnong ne ka ri ne kiba kum kita kat kum ka jingheh jong ki.

Ki nongshna dur ne engineer haba ki kwah ban shna ia ka ting ne jingkieng ne surok bad kiwei kiwei, ki mutdur shuwa ha ka kotsada ia ka plan jong kata kaba ki thmu ban shna da kaba pynrit ia ka jingthew kata ka dur kat ban biang ha ka kotsada Ia kaba kum kane ka jingring dur ki khot kaba ring dur ne shna dur kat kum ka scale

Ka map ne ka plan ka long ka dur ba la pynrit kaba long ka kopi ba dei thik jong ka ri ne jaka kaba ka teng. Namarkata, haba thew ia ka jingjingai hapjeng ar tylli ki dak jong ki shnong ba la buh ha ka map ngi lah ban tip ia ka jingjingai jong kita ki shnong kumba ki long.

Tharai, lada 1 inshi ba la thew ha ka map ka teng na ka bynta ka jingjingai 10 mile, 2 inshi kan teng na ka bynta 20 mile, 4.5 inshi na ka bynta 45 mile bad ter ter. Ia kaba kum kata ka map la ong ba la shna ha ka scale 10 mile shi inshi.

1. Ring u line uba $3' 6''$ ka lynter ha ka scale $1'' = 1'$.



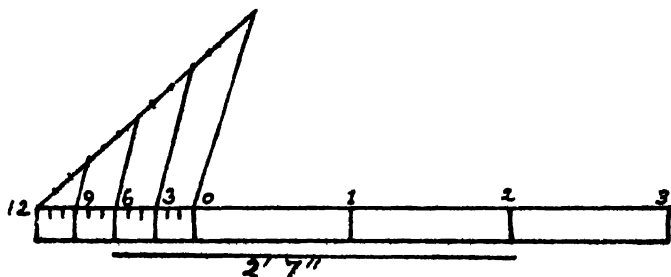
Ring uwei u line kumba la leh ha kane ka dur bad thew 3 inshi bad shiteng inshi.

Ka jingjrong jong une u line ba la ring ka long $3\frac{1}{2}'$, hynrei namar $1''$ ka leng na ka bynta $1'$, une u line u leng na ka bynta $3' 6''$.

Ka scale ba la pyndonkam hangne ka long shi inshi na ka bynta shi phut. Lah ban thoh lyngkot kumne—

Scale $1'' = 1'$.

Lane, Scale $\frac{1}{12}$, namar $1''$ ka leng na ka bynta $12''$.



2. Ring u line $2' 7''$ ka lynter ha ka scale $1'' = 1'$.

To ngin shna shuwa la ka scale $1'' = 1'$ kumne—

Khmih bha kumno la shna la katei ha scale. Ka lynter kane ka scale ka long 4 inshi. Ia ka shi inshi kaba sha ka tduh kadiang ka scale la bynta ha ki 12 bynta kiba la ryngkat, da ka jinglarap ka problem 9.

Namar shi inshi ka ñeng na ka bynta shi phut, kumta iwei-pa-iwei i bynta ba la bynta i ñeng shi bynta na ka 12 bynta jong ka shi inshi. Katei ka scale baroh kawei ka ñeng na ka bynta ka 4 phut. Ban ñoh ña ka jingthew ka ban ñeng ña u line uba 2' 7" shim 2 inshi bad 7 bynta na ka 12 bynta jong ka shi inshi kumba la pyni da u line ba la ring hapoh katei ka scale.

Utei u line u ñeng namarkata, na ka bynta 2' 7".

3. Pyndonkam da katei kajuh ka scale bad ring ña kine ki line :—

1' 9" ; 3' 2" ; 2' 7 $\frac{1}{2}$ " ; bad 8 $\frac{1}{2}$ ".

4. Shna ka scale kaba 1" = 1 kot bad da ka, ring ki line 3 kot 2 phut, 1 kot 2 phut bad, 4' 6" ka lynter.

[Hangne ña ka shi inshi ha ka tduh kadiang ka scale yn bynta ha ki 3 bynta ba ña biang ban ñoh ña ka jingjingai kaba ñeng ña ki phut]

5. Ha ka plan ka ñing kaba ka scale $\frac{1}{2}$ " = 1 phut la shem ba don ki line kiba 8", 6 $\frac{1}{2}$ ", $\frac{1}{4}$ " bad 2 $\frac{1}{4}$ ". Katno ka jingjrongo jong kita ki line ha kata ka ñing?

$\frac{1}{2}$ " = 1 phut.

6" = 2 × 6 lane 12 phut.

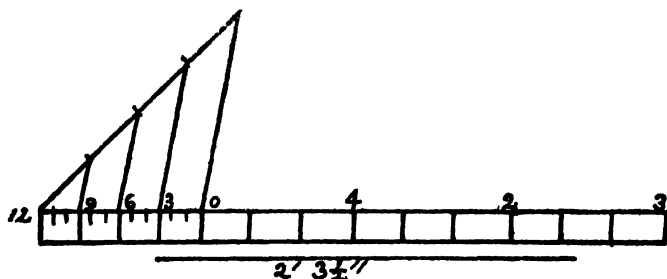
6. Shna ka plan jong ka ñing kaba ka lynter ka dong ñing ka long 24 phut bad ka pyngkiang 12 phut. Pynkha baranda 4 phut sha khmat baroh shi lynter. Scale 1" = 4'.

7. ña ka plan jong kawei ka kper la shna ha ka scale 50 kot shi inshi—

(i) 4' 6" ka jingjingai ha ka plan ka ñeng ña ka jingjingai kaba katno ha ka kper?

(ii) Katno ka jingjingai ha katei ka plan ka ban ñeng na ka bynta 480 kot ?

8. Shna ka scale kaba $1\frac{1}{2}$ " ka ban ieng na ka bynta ka 1 phut, bad da ka, ring line ki ban ieng ia u line uba $2' 3\frac{1}{4}"$; $7''$; $1' 1\frac{1}{2}"$ bad $11\frac{1}{2}"$ ka jingjrong.



Ring u line uba jrong 6 inshi. Buh dak ha man la ka $1\frac{1}{2}$ ", kumba la pyini ha ka dur. Bynta ia ka $1\frac{1}{2}"$ kaba ha ka tduh kadiang jong ka scale ha ki 12 bynta kiba ia marbiang marbiang. Kumta iwei iwei i bynta in ieng shi bynta na ka 12 bynta ka $1\frac{1}{2}"$.

Ring u line hapoh ka scale uba jrong ar shah ki $1\frac{1}{2}"$ bad sa 3 bynta shiteng na ka $1\frac{1}{2}"$.

Utei u line u ieng ia u line $2' 3\frac{1}{4}"$.

9. Ha ka map kaba ka scale, $1" = 16$ mile, ka jingjngaⁱ na Shillong ha Sohra la pyini ba ka long $1' 3"$. Katno ka jingjingai lada iaid beit siak na Shillong ha Sohra?

Ka Jowai ka jngai 22.4 mile haba thew beit siak na Shillong; katno ka jingjingai kine ki jaka ha ka map kaba ha katei ka scale?

10. Nga iaid 40 kot beit siak shaphang shatei nangta nga iaid 30 kot beit siak shaphang mihngi. Shna ka plan ia kane ha ka scale 1 inshi = 10 kot; shem da kaba thew ia ka jingjingai ka jaka ba nga don na ka jaka ba nga mih.

11. *Ya u dieng lama uba jrong 32 phut na khyndew la pynskhem da kaba teh tyllai na kliar ha u khuti uba sieh ha khyndew 24 phut na trai u dieng lama. Shna dur ia kane ha ka scale 8 phut = 1 inshi bad shem ia ka jingjrong u tyllai.*

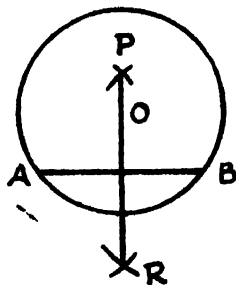
12. *Nga pyndem ia ka jingkieng ha ka kynroh ting. Ka khlieh jingkieng ka kot 16 phut bad ka kjat jingkieng pat ka don 12 phut na trai kynroh. Shna plan ia kane ha ka scale 4 phut = 1 inshi bad pyndonkam ia ka ban shem ia ka jingjrong ka jingkieng.*

LYNNONG XIX

KI CIRCLF

Shna dur ban pyni ba u perpendicular ba la ring ha u chord jong ka circle na ka pdeng jong u u laid lyngba ka centre.

Jingshna dur — Ring kawei ka circle na ka centre *O*. Ring uwei u chord *AB* ha ka. Ot ia u *AB* marshiteng da u line *PR* uba da pynlong ki right angle bad u *AB* da ka jingjarap ka Problem 1.



Ngi iohi ba une u perpendicular u laid lyngba ka centre O.

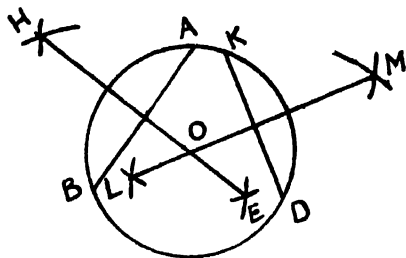
Shim katto katne ki point ha u PR bad thew ia ka jingjrong jong ki na u A bad u B.

Ngi shem ba ki jingjngai kano kano ka point ha u line PR na u A bad u B ki ia katjuh.

Ngi tip ruh ba ka centre O ka jngai katjuh na u point A bad B kiba long ki point ha ka circumference jong ka circle kaba ka point O ka long ka centre.

Namarkata, ka point O ka dei ban don ha u line PR.

2. *Shna dur ban pyni ba ki perpendicular ba la ring ha ki chord ka circle na ki middle point jong ki ki ia pom ha ka centre.*



Jingsbnadur — Ring kawei ka circle na ka centre **O**. Shim ar tylli ki chord **AB** bad **KD** ha ka.

Ot marshiteng ia u **AB** da u line **EH** uba da pynlong ki right angle bad u **AB**.

Ot marshiteng ia u **KD** da u line **LM** uba da pynlong ki right angle bad u **KD**.

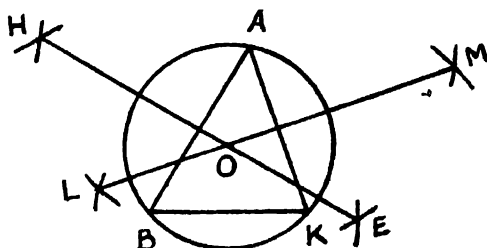
Na katei ka jingpyrshang haneng ngi iohi ba u line **EH** u ia id lyngba ka centre **O** bad kumjuh ruh u line **LM**.

Thew ruh ia u **OA**, **OB**, **OK**, bad **OD**. Phi shem kine ki ia dei kumno?

Namarkata, ngi ong ba ki perpendicular ba la ring ha ki chord ka circle lyngba ki middle point jong ki ki ia pom ha ka centre.

PROBLEM 23

Ban ring ka circle ka ban laid lyngba ia ki vertex jong ka triangle ba la ai.



La ai ka $\triangle ABK$.

Jingshnadur — Ot marshiteng ia u AB da u line EH uba da pynlong ki right angle bad u AB.

Ot marshiteng ia u AK da u line LM uba da pynlong ki right angle bad u AK.

Ai ba u EH bad LM kin ia pom ha u O.

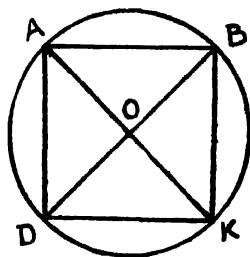
Thew ia ka jingjingai ka point O na ka point A, B bad K, Phi shem kine ki ia dei kumno?

Na ka point O kum ka centie bad da u radius OA ring circle.

Kane ka circle ka laid lyngba u B bad u K. Balei?

PROBLEM 24

Ban ring ia ka circle ka ban laid lyngba ia ki vertex jong ka square.



La ai ka square ABKD.

Pynlasoh ia ki diagonal AK bad DB. Kine ki diagonal ki da ia pom ha u O.

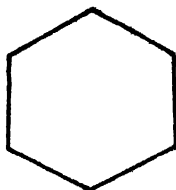
Na ka centre O bad da u radius OA ring circle.

Kane ka circle ka dei ban laid lyngba ki point B, K bad D namar ba u $OA = OK = OB = OD$.

LYNNONG XX

BAN SHNA IA KI KATTO KATNE KI NUKSA

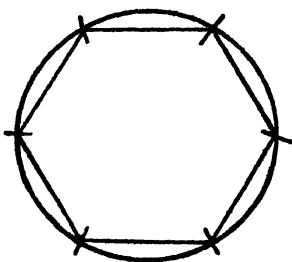
Ia ki dur ba la ker kut da palat ia ki saw side ki khot **polygon**. Ia ka polygon kaba ki side bad ki angle jong ka ki ia ryngkat ki khot **regular polygon**.



Ka polygon kaba san				side ki khot			Pentagon
„	„	„	hynriew	„	„	„	Hexagon
„	„	„	hynñiew	„	„	„	Heptagon
„	„	„	phra	„	„	„	Octagon
„	„	„	shiphew	„	„	„	Decagon
„	„	„	khatar	„	„	„	Dodecagon
„	„	„	khatsan	„	„	„	Quindecagon.

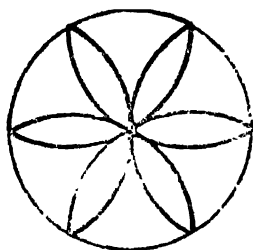
1. Ring circle da u radius 2'0".

Sdang na kano kano ka point ha ka circumference kane ka circle bad da u compass jam sawdong ia ka, da buh dak artat man ka sien ba phi jam. Ka jingjam ba phi jam kan long barabor kat u radius ba phi ring ia ka circle.

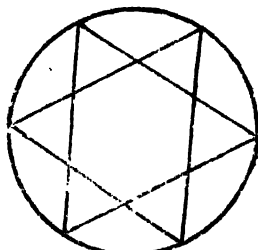


Katno sien phi jam sawdong ia ka circumference?

Pynñasoh ter ter ia ki dak jam ba phi la buh ha ka circumference. Kine ki line ba phi pynñasoh ki dei kiej? Katno ka jingjong uwei uwei na ki? Ka nuksa aiu phi ioh na kane ka dur?



Dur 1



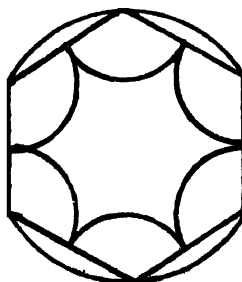
Dur 2

2. Ring circle bad da buh dak ha ka circumference kumba phi la leh ha ka jingpyrshang 1.

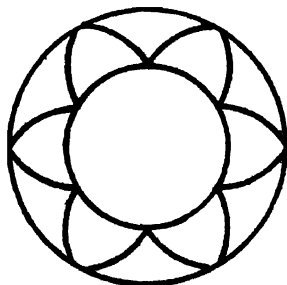
Na kawei-pa-kawei ka dak ba la buh shim ia ka kum ka centre bad da ujuh u radius ring arc kiba ki tduh jong ki kin la shem bad ka circumference ka circle ba la ring. Leh ter ter ia man la ka dak ba la buh ha ka circumference. Haba la dep phi loh ia ka nuksa ba la pyni ha ka dur 1.

Pyniasoh ia ki dak ba la buh ha ka circumference ha kata ka rukom ba yn long dur triangle. Ngi loh ia ka nuksa ha ka dur 2. Ka nuksa dur khlur.

3. Shna ia kine ki nuksa harum—



Dur 1



Dur 2

Dur 1.— Ring shuwa ia ka circle da buh dak ha ka circumference kumba phi la leh ha ka jingpyrshang 1. Ring ia kitei ki chord bad shim ia kawei-pa-kawei ka dak ba la

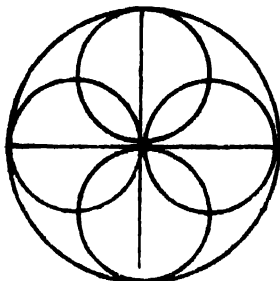
buh kum ka centre bad da u radius uba shiteng ka jing-jrong u radius jong ka circle ba la ring, ring arc kiba ki tduh jong ki kin ia shem bad ki chord. Phi loh ia ka dur 1.

Dur 2.— Ring shuwa ia ka circle rit da buh dak ha ka circumference jong ka kumba phi la leh ha ka jingpyrshang 1.

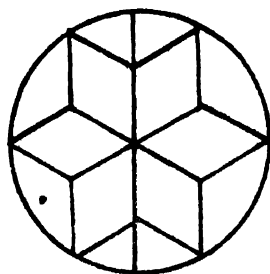
Shim ia kawei-pa-kawei ka dak ba la buh kum ka centre bad da ujuh u radius ring ia ki arc.

Sa ring khatduh ia ka circle heh.

4. Shna ia kine ki nuksa harum. Ka jingbeh jong ki kan long ar shah ia kine ki dur.



Dur 1



Dur 2

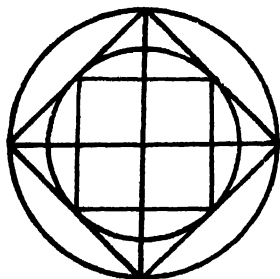
Dur 1—Ring kawei ka circle da u radius uba 2 inshi. Ring ar tylli ki diameter kiba da pynlong ki right angle ha ka centre.

Na ka centre jong kane ka circle bad da u radius uba shiteng ka jingjong u radius ka circle ba la ring, ot ia kine ki diameter.

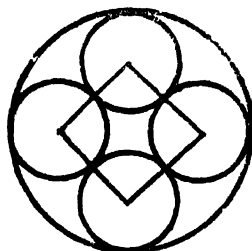
Shim ia kawei-pa-kawei na kine ki point kum ka centre bad sa ring ia kitei ki saw circle kiba hapoh ka circle ba la ring.

Dur 2.— Ring shuwa kawei ka circle bad da buh dak ha ka circumference jong ka kumba phi la leh ha ka jingpyrshang 1, tang ba u radius un long tang shiteng na u radius ka circle. Sa ring ia katei ka dur na ki dak ba la buh.

5. Shna sa ña kine ki nuksa.



Dur 1



Dur 2

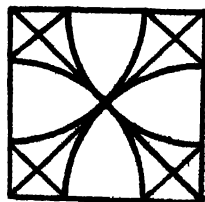
Dur 1. Shna shuwa ña ka square kaba heh kaba u diagonal jong ka u long 3". Na ka point kaba ña pom ki diagonal kum ka centre bad u radius uba ña ryngkat shiteng ña u diagonal jong ka square ring ña ka circle. Da u radius uba ña ryngkat ka jingjngai na ka centre ha ka middle point jong ki side ka square ring sa ña ka circle rit.

Sa ring dur sa ña ka square rit.

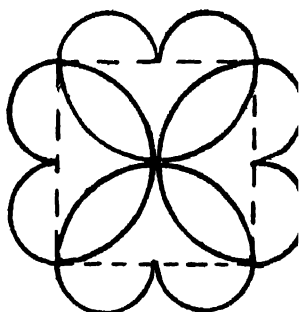
Dur 2. Shna shuwa ña ka square ha u diagonal uba 2". Nangta sa ña ki circle rit bad khatduh ña ka circle heh.

6. Shna ña kane ka nuksa—

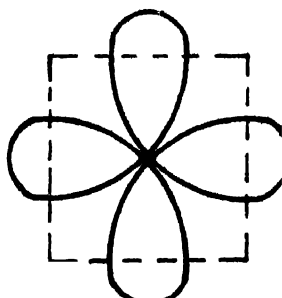
Shna shuwa kawei ka square. Pynlasoh ña ki diagonal. Na ki vertex jong kane ka square kum ka centre bad da u radius uba ña ryngkat ña ka shiteng u diagonal ring ña ki arc bad sa pyndep ña kaba sah.



7. Shna ya kine ki nuksa harum. Ka jingheh jong ki kan long ar shah ya kine ki dur



Dur 1



Dur 2

Dur 1. Shna shuwa kawei ka square. Ki curve baroh kiba hapoh kane ki square ki dei ki semicircle ba la shna ha uwei-pa uwei u side kum u diameter. Kiba shabar ka square ki dei ki semicircle ha ka shiteng u side ka square kum u diameter.

Dur 2. Shna shuwa kawei ka square. Ki arc ba hapoh ka square la ring na ki vertex jong ka kum ki centre bad da u radius uba long shiteng na u diagonal jong ka square. Kiwei pat ki curve ki long ki semicircle.

**MEGHALAYA STATE CENTRAL
LIBRARY SHILLONG**

Call No.

Date,

Ka

Geometry Khasi

May 1979 — 8000 Copies

La shon ha Ri Khasi Press, Umsohsun, Shillong-1